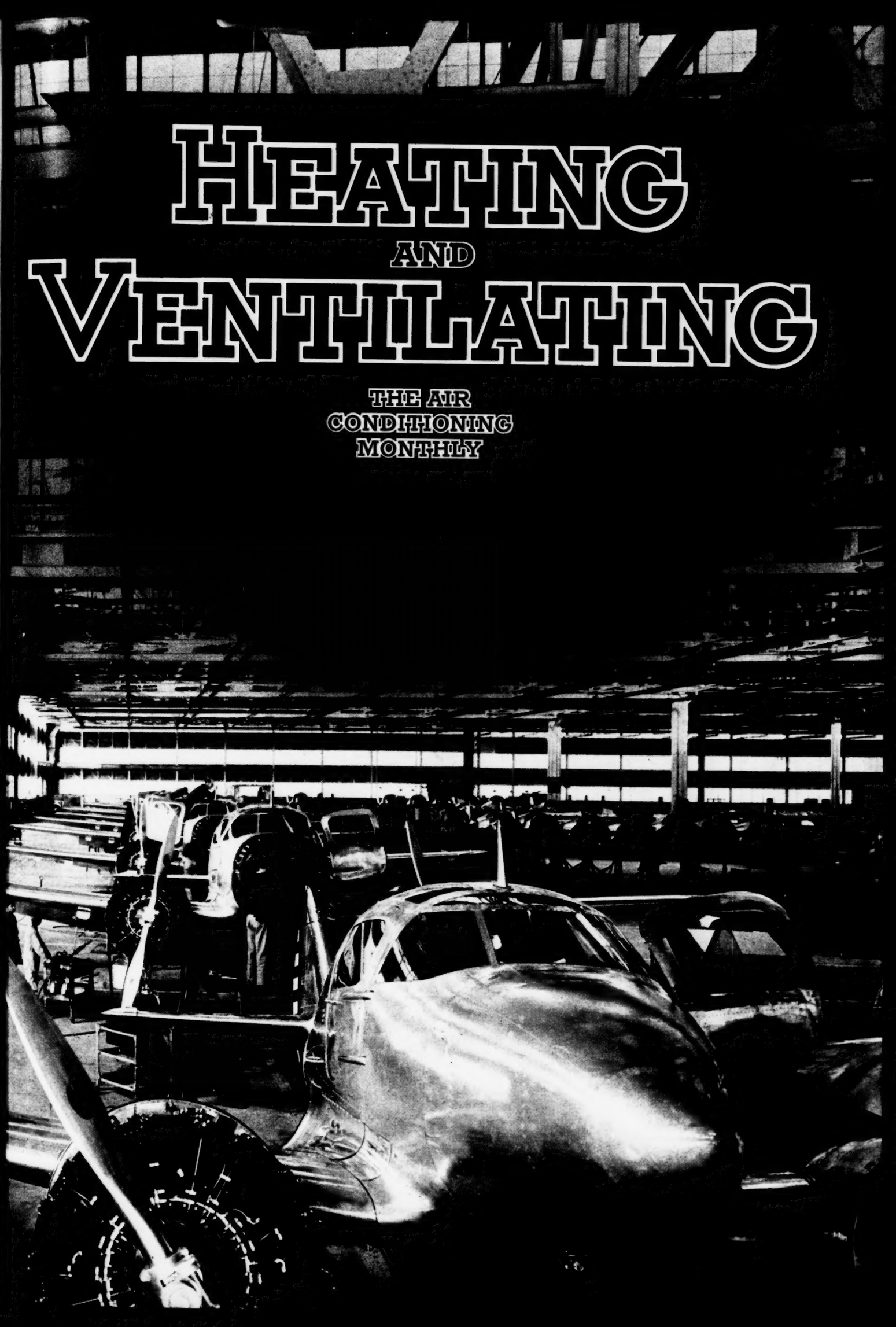
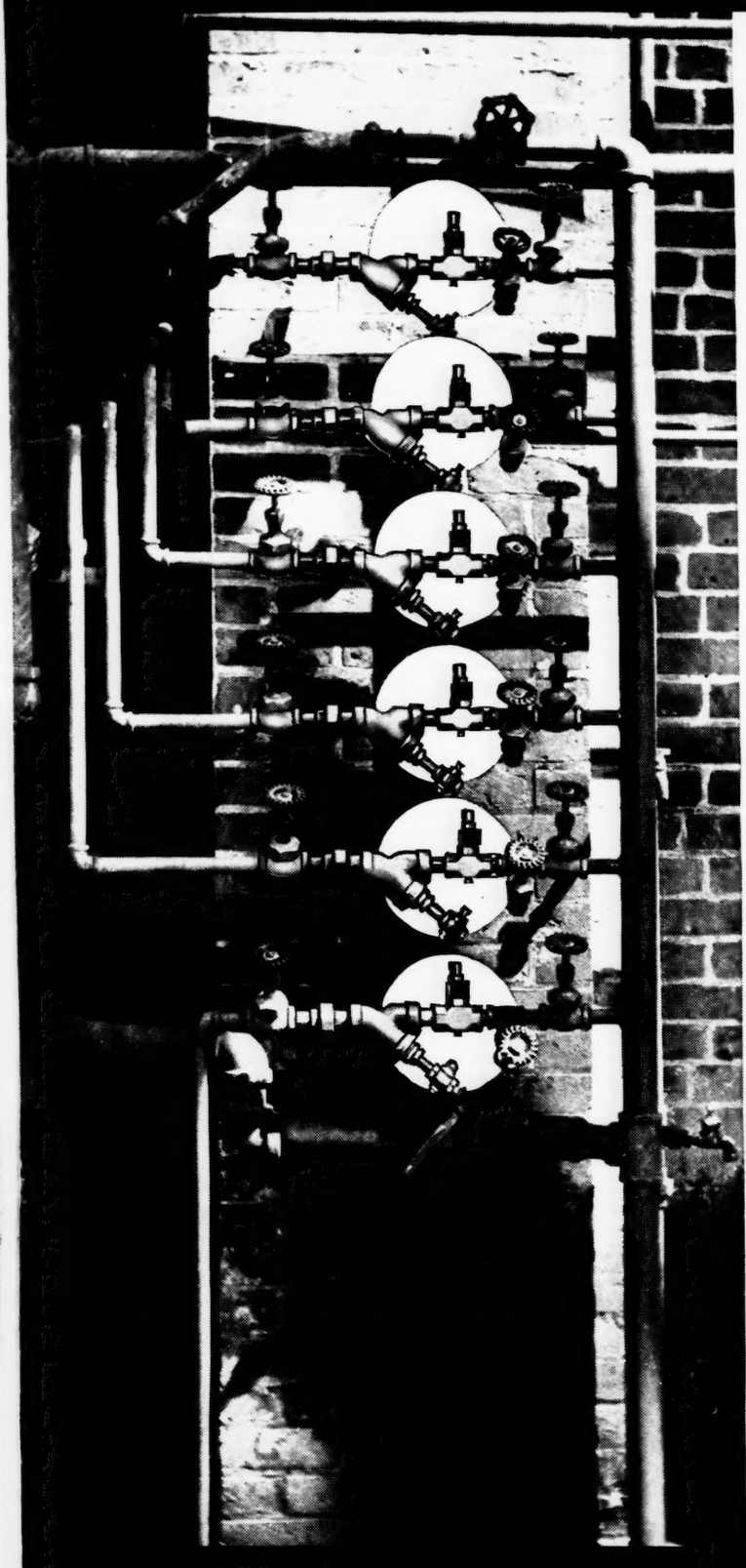
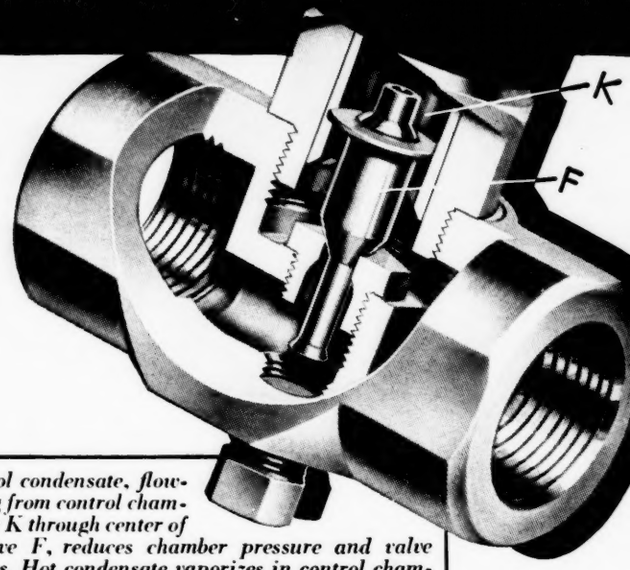
# HEATING AND VENTILATING

THE AIR CONDITIONING MONTHLY



# World's Largest Cotton-Seed Cooker is YARWAY TRAPPED



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**YARNALL-WARING COMPANY**
104 Mermaid Avenue, Philadelphia, Pa.

# HEATING AND VENTILATING

*The Air Conditioning Monthly*

*or*

ngineers and contractors ontrolling the design, pecification, installation nd maintenance of heat- ng, ventilating and air onditioning.


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THIS MONTH'S COVER

This Curtiss-Wright plant designed by Albert Kahn Associated Architects and Engineers, Inc., is heated by revolving unit heaters located high in the trusses.


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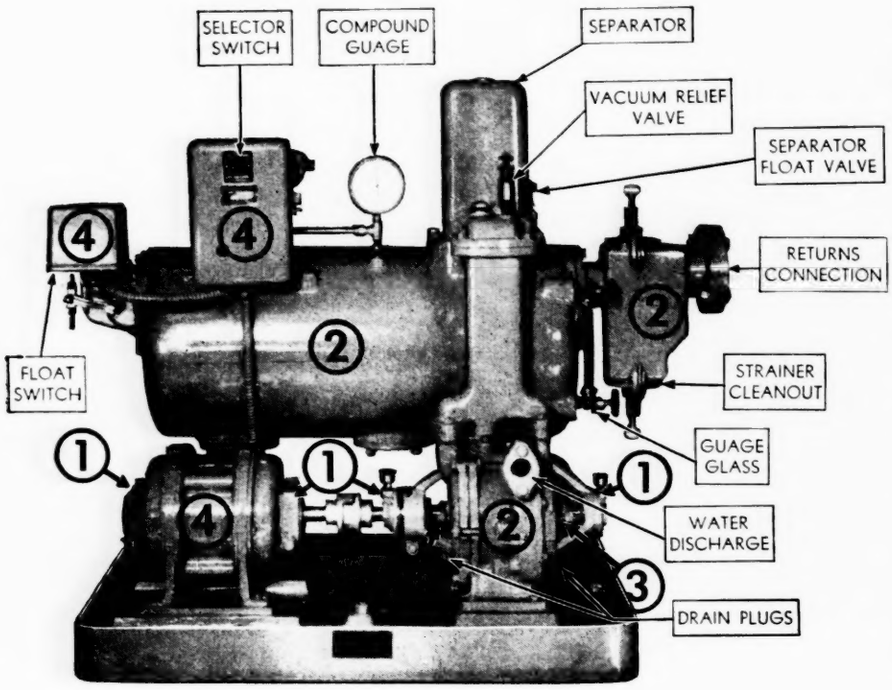
# How to keep your Jennings Heating Pumps in First Class operating condition for Duration...




## YOUR JENNINGS RETURN LINE VACUUM HEATING PUMPS

are an important part of plant or building equipment. They cannot be easily replaced and must last for a long time. Jennings Pumps are designed for long life, and have extra capacity which will count when it may be difficult to maintain lines and equipment free from leaks, but to give full service they must have proper care.

Now that these pumps have been in service all winter on the heating system, they should have a thorough inspection. Special attention should be given to the bearings, as no wearing contact occurs in a Jennings Pump as long as the ball bearings are properly maintained.

In most cases Jennings Pumps will require only the check-up we have recommended. If additional adjustments or repairs are found to be necessary, they should be undertaken at once. Do not wait until both time and materials are running short. Nash Service Branches are established throughout the United States. If you do not know the address of the one nearest to you, write directly to this office. Nash Service is yours to command, NOW.

## SERVICE POINTERS

**1** LUBRICATE PUMP AND MOTOR BEARINGS . . . Check bearings for end play, or radial play, and be sure they contain no grit, or foreign matter. If found to be clean and in good condition, fill with proper non-acid grease lubricant. If motor has oil lubricated bearings, flush out with fresh oil, and refill.

**2** CLEAN STRAINER AND STRAINER SCREEN . . . Clean strainer well and strainer screen. If screen is found to be worn, and has passed foreign matter, thoroughly flush both receiving tank and pump casing. Drain plugs are conveniently located . . . Damaged screen should be repaired or replaced at once.

**3** RENEW STUFFING BOX PACKING . . . Remove old packing and clean stuffing box. Fill with new loose-woven graphite-impregnated stuffing box packing, in individual rings. Be sure joints are staggered, and that ends butt properly without over-lapping. Do not finally tighten gland until pump is again in operation.

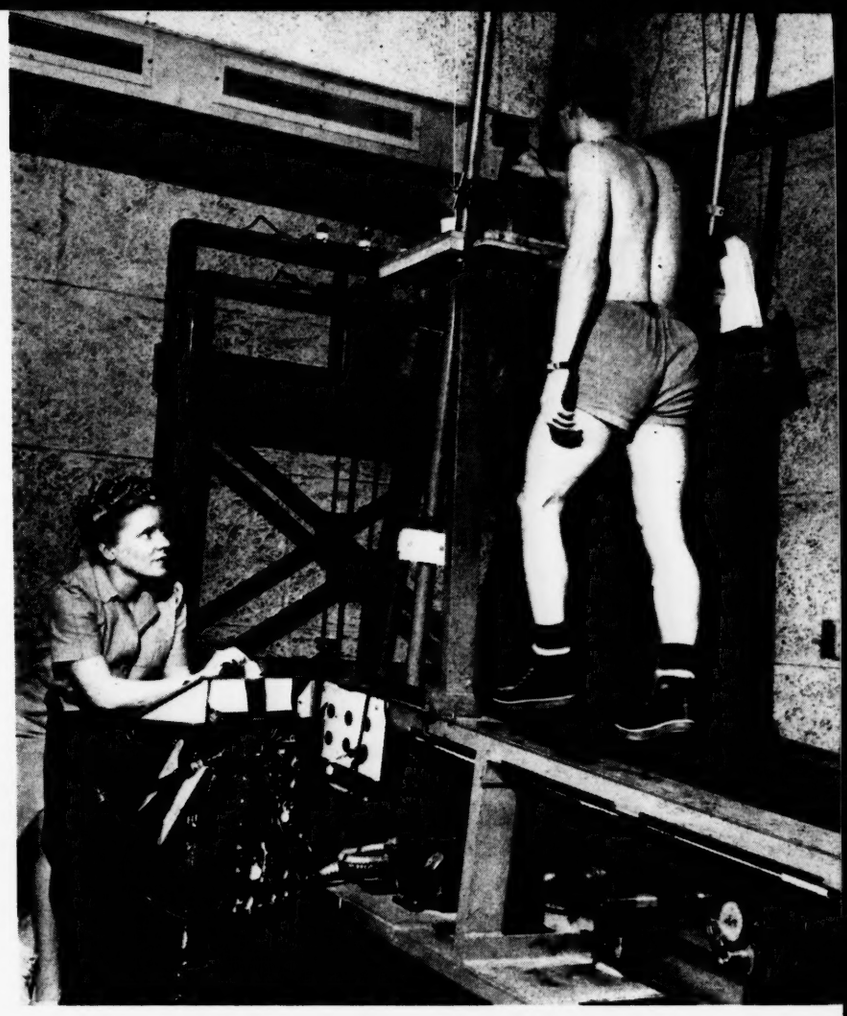
**4** HAVE MOTOR AND CONTROL INSPECTED . . . Have an experienced electrical service man go carefully over motor and control. Follow his recommendations and if repairs or replacements are indicated, have the work done immediately.

**5** CHECK OPERATOR'S INSTRUCTION BOOK . . . If operating instructions originally furnished with the pumps have been lost, write to us at once for a new copy for each pump. BE SURE TO FURNISH US THE TEST NUMBER OF EACH PUMP, as stamped on the pump name plate.

**6** IF PUMPS REQUIRE REPAIRS . . . and you do not know the address of our nearest Service Branch, notify us at once, and we will have our Service Engineer get in touch with you without delay . . . There are well equipped Nash Service Branches in most principal cities ready to give you every possible help

**NASH ENGINEERING COMPANY**

**254 S. WILSON ROAD • SOUTH NORWALK, CONN.**



Treadmill measures work output of subject under given ration and under given climatic conditions to determine proper diet for soldiers. Air conditioning enables tropical, temperate or arctic temperatures to be duplicated in this laboratory located at the University of Minnesota. Velocitrol inlets are shown at the top.

# AIR CONDITIONING HELPS ARMY

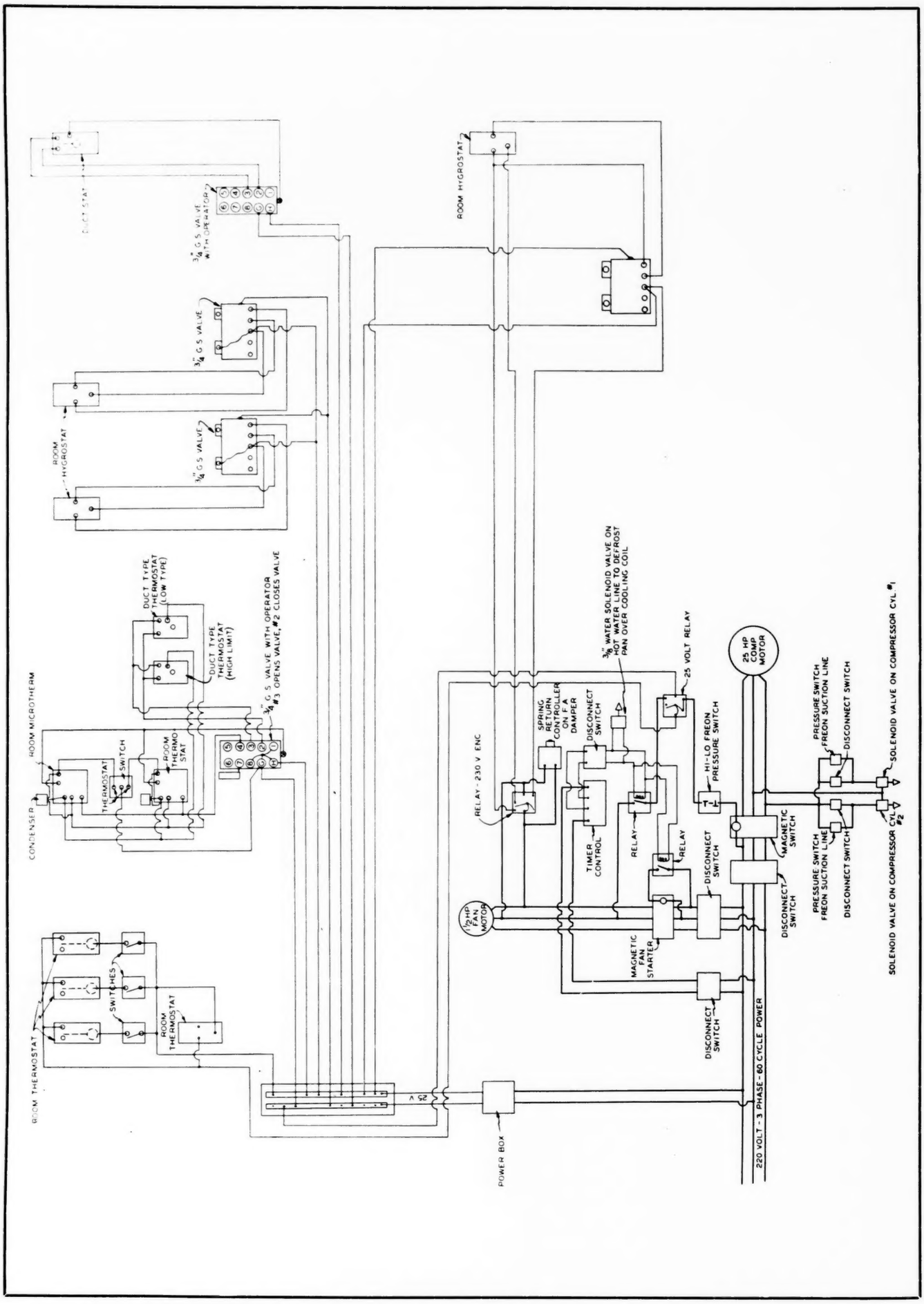
## *determine rations required under climatic conditions which vary sharply among the different widely separated theatres of war. The conditioned laboratory described by Milton Figen.*

WORLD War II involves military operations on a large scale under highly diversified, and often unfavorable, climatic conditions. These conditions vary from arctic cold to humid tropics and arid deserts. To sustain them and keep them in fighting trim wherever they are, soldiers cannot depend upon one kind of ration. They must have food to suit the climate, to suit the seasonal cycle of that climate, and to suit the energy demands made upon them by the particular kind of military operations in which they are engaged.

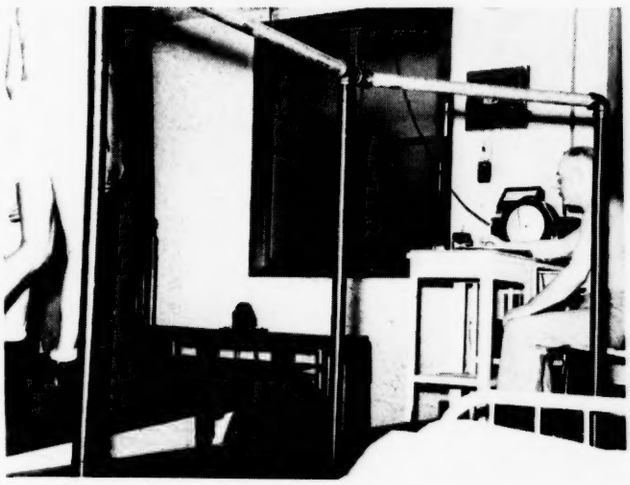
The Quartermaster General's Office and the Office of Scientific Research and Development in Washington do not leave the determination of these foods and their effects upon military personnel to chance. At various universities and research laboratories throughout the country scientific studies on rations and their effectiveness under varying conditions are being studied in co-operation with the Quartermaster General's Office. One such ration study center is the Laboratory of Physiological Hygiene, under the direction of Dr. Ancel Keys, at the University of Minnesota. At this laboratory soldiers work, march on a treadmill, eat and sleep in spaces with a wide range of separately controlled, interlocking temperature and humidity zones designed to simulate the variety of climatic conditions under which American soldiers are fighting in the present war.

Volunteer soldiers serving as subjects are fed tentative rations. They remain in the space days and even weeks. They march on a motor-driven treadmill at speeds between 1½ to 15 mph and at angles of inclination from zero up to a 20% grade. Accurate metabolic and other physiological tests, such as blood-sugar level, water-intake and gastro-intestinal reaction are tested to determine the efficiency of the proposed menu.

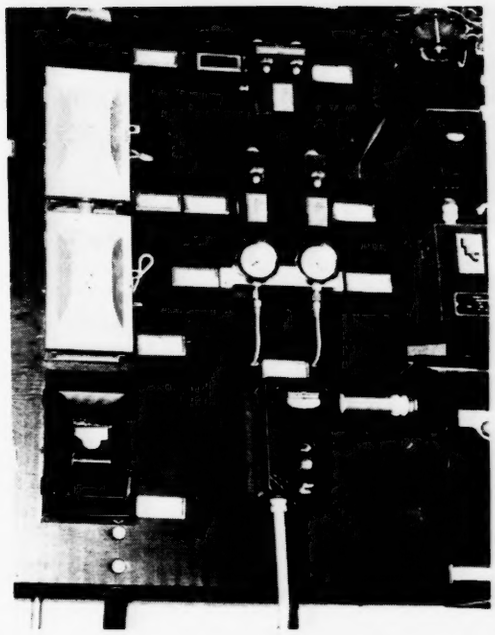
This is the general plan under which the labora-




**Control diagram for the air conditioning of the fatigue laboratory at the University of Minnesota.**



**Another view of the treadmill, with subject at the left, timekeeper at right.**



**View of control panel showing starting switches, compressor controls, and controls for wet and dry bulb.**

tory is operated. Design conditions called for the following range of inside temperatures and humidities:

| Dry Bulb, F | Relative Humidity, % |
|---|---|
| 120 | 85 |
| 120 | 35 |
| 95 | 85 |
| 78 | 50 |
| 35 | 50 |

under a minimum outdoor temperature of — 20F and a maximum of 95F dry bulb and 75F wet bulb. Allowed variations are one degree plus or minus from set wet and dry bulb points.

The conditioned space, divided into three rooms —one for sleeping, one for eating and one for working — has a total volume of 9,000 cubic feet. The system circulates a total of 4,000 cfm of air, 500 cfm of which is outside air, thus delivering a 2¼ minute air change which is essential to the conditions under which the testing goes on.

The conditioned area is partitioned off from the rest of the building in which it is located by two 2 in. thicknesses of Thermax, with a vapor seal between each thickness of wall and on the outside and inside, thus providing an effective heat and moisture barrier.

The cooling load is carried by a three - cylinder Frick condensing unit, equipped with reduction unloaders of 66 2/3 and 33 1/3% capacities, and driven by a 25 hp 1740 rpm 3-phase, 220-volt motor.

The cooling coil has a 12.3 sq ft face area, and is six rows deep. The non-freeze type heating coil in the air conditioning unit has the same face area and is one row deep. A non-freeze coil is also located in the fresh air duct to temper the incoming fresh air. A 21-inch double width, double inlet fan driven by a 1½ hp motor supplies the 4,000 cfm to the conditioned space. Humidity is furnished by three grid humidifiers, one being located in the air conditioning unit and two in the conditioned space.

Because of the wide range in temperatures and humidities required, the installation involved a definite control problem. The equipment includes the following:

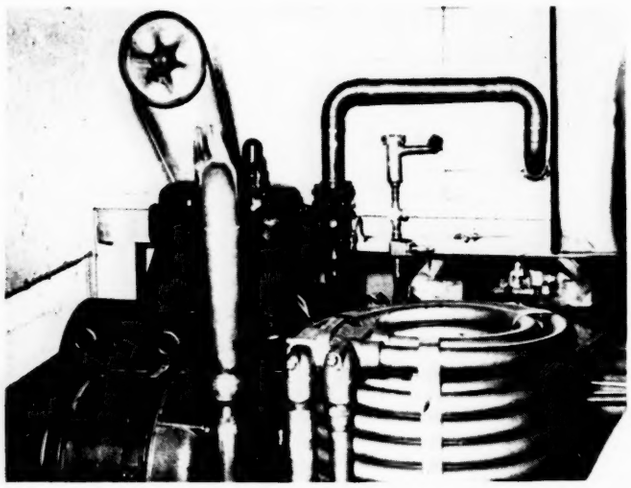
A system of Barber-Colman controls regulates wet and dry bulb temperatures. The compressor is actuated by White-Rodgers pressure controls. Due to the range of room temperatures from 35 to 120F, it was necessary to employ five room thermostats, two on the heating and three on the cooling cycle. On the cooling cycle thermostat No. 1 controls the temperature from 35 to 65F, thermostat No. 2 from 65 to 95F, and thermostat No. 3 from 95 to 120F. On the heating cycle, the first thermostat controls from 35 to 75F, and the second from 75 to 120F. Manual toggle switches determine which heating and which cooling thermostat shall be in control.

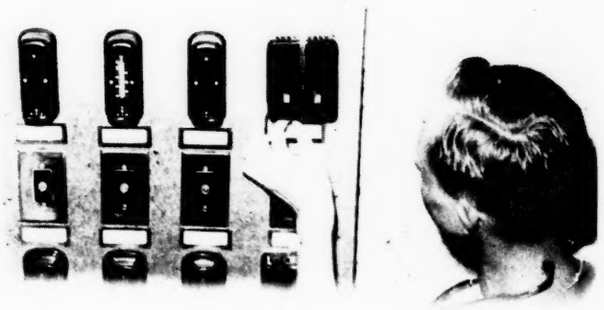
A humidistat is in parallel with the three cooling thermostats and overcalls whichever one is in control, if relative humidity is above the set condition, to operate the compressor.

A modulating steam valve, governed by either of the two heating cycle thermostats, is provided in the steam line. Ductstats in the fan discharge limit the minimum and maximum temperatures of the air leaving the heating coil. Each of three additional humidistats operates steam valves on each of the three steam grid humidifiers.

The steam coil on the fresh air duct is controlled by a ductstat in the discharge side of the coil which operates a modulating steam valve on the heating coil. The fresh air duct has an automatic damper which closes when the air conditioning fan stops. A relay closes the steam valve to the grid humidifier in the air conditioning unit when the fan motor stops. The compressor is wired to stop when the air conditioning fan motor stops.

Every two hours during operation of the system at low room temperatures a timer clock shuts off the compressor and air conditioning unit and at the same



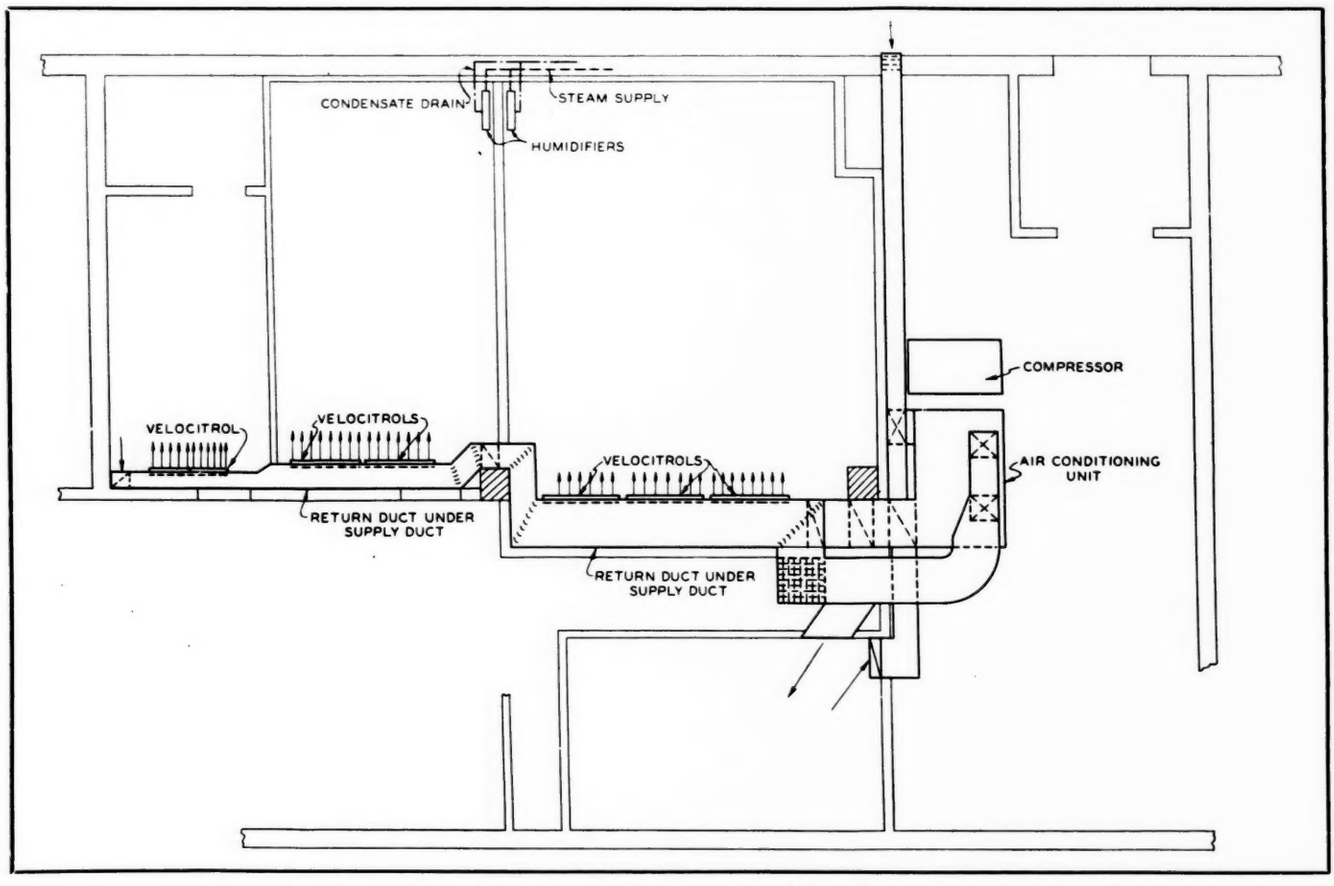


**(Left) Condensing unit and conditioner in the laboratory. (Right) Attending doctor setting manual controls on the panel inside the conditioned space.**

time energizes a solenoid valve on the hot water line which allows hot water to run over the cooling coil and remove all ice. A manual switch is wired in series with the timer motor so the equipment does not go into a defrosting cycle when the coil is operating above freezing temperature. The solenoid valves operating the unloaders on the compressor are controlled by pressurestats and manual switches to reduce the capacity of the compressor as the cooling load drops off. When maintaining a room temperature of between 100 and 120F, the compressor runs at 33 1/3% capacity and the solenoids on the unloaders are energized by the use of manual switches in parallel with the pressure switches positively to reduce the capacity.

A picture of how the controls operate over the wide range of wet and dry bulb temperatures required in simulating various climatic conditions can best be given by taking two sets of conditions as samples. One is at 35F D.B. with 85% relative humidity and the other is 120F D.B. with 35% relative humidity. Both are extreme and for this reason provide a good index of the flexibility of the system.

The controlling heating and cooling thermostats are set at 35F and the four humidistats are set for 85% relative humidity. The ductstat controlling




**Plan view of laboratory showing arrangement of conditioning equipment and ducts.**

the fresh air steam coil is set at 35F. When cooling is needed, the room cooling thermostat starts the compressor and the air is cooled below 20F. One limit switch in the fan discharge then operates the steam valve on the heating coil to reheat the air to a minimum of 20F. If heat is needed, the room heating thermostat modulates the steam valve to deliver the desired temperature of heated air. If the valve should open too much, another limit switch in the fan discharge limits the maximum delivered air temperature to 40F. Due to the rapid air change in the conditioned space, it is desirable to limit the maximum and minimum air temperature delivered to the room to obtain the close temperature regulation needed. If the humidity should rise above 85% the humidistat wired in parallel with the cooling thermostats starts the compressor, thus condensing moisture from the air passing over the Freon coil. As cooling is not needed during this operation, the heating coil raises the temperature to 35F or above as needed to maintain the room temperature of 35F.

Saturated air at 20F does not have enough moisture content to maintain a room at 85% when the temperature is raised to 35F. Therefore it is necessary to have a supplementary means of adding moisture. This is done by evaporating water in the two grid type humidifiers in the conditioned area. Each of these humidifiers and the grid humidifier in the air conditioning unit is controlled by a separate humidistat operating two-position steam valves on each unit.

At the end of two hours of operation the timer clock shuts off the compressor and air conditioning unit and turns on the hot water to defrost the cooling coil. At the end of the defrost cycle the hot water is shut off and the system started again.

One pressurestat controlling the solenoid valve on the compressor unloader is set for 12 lb and the other for 9 lb.

Suppose, as an additional example that 120F D.B. and 35% relative humidity are desired:

The cooling and heating thermostats used during high room temperature are set for 120F and the four humidistats are set for 35% relative humidity. The duct switch controlling the fresh air steam coil is set for 120F. As the room temperature rises above 120F, the cooling thermostat starts the compressor. As only one-third compressor capacity is needed, the solenoid valves on the compressor unloaders are energized by closing manual switches in parallel with the pressure switches. The low-limit switch in the fan discharge opens the steam valve on the heating coil to reheat the air to 113F, which is the minimum temperature needed for cooling. When heat is needed the heating thermostat modulates the steam valve to deliver the needed temperature of air, but the high-limit switch in the fan discharge limits the maximum delivered air temperature to 140F.

Humidity is added as needed by the humidistat opening the steam valves in the grid humidifiers. If dehumidification is needed the control operates as described in the problem of 35F and 85% relative humidity. No defrosting cycle is needed at this condition so a manual switch is opened in the timer control circuit to prevent the system from shutting down at the two hour period.

The laboratory is not being used for low temperature studies at present. The general standard "control environment" maintained is 78F with 58% relative humidity for daytime conditions and 65F and 50% relative humidity for night conditions.

According to Dr. Keys, the tropical and desert environments simulated in contrast to the control environment are somewhat more extreme than naturally occur. This is done to test the diets and rations under the most adverse conditions that American soldiers may have to encounter. Thus, for desert climates, temperatures are maintained up to 120F with 30% relative humidity for daytime conditions (while this humidity is below what the design of the system calls for, the system is flexible enough to maintain it), and 90F and 35% relative humidity for nighttime conditions. The range of laboratory tropical temperatures is from 90F for night to 105F for day, with 85% saturation for night and 80% saturation for day.

The air conditioning system was designed by J. F. Siegel of Yale Engineers, Inc., Minneapolis, Minn.

## Burning Wood in Furnaces

Those considering wood for furnace or boiler fuel this winter in view of the uncertainty of coal or oil supply may not need a new grate, U. S. Department of Agriculture's Forest Service reports. Many furnaces burn wood more efficiently without a grate.

Removal of the grate may be advisable to provide sufficient combustion space, which needs to be two-thirds greater for firing with wood. With grates removed and using the ashpit floor as a fuel bed, it is often possible to increase the space available for burning the volume of combustible gases released from wood. Increasing this space prevents the larger flames from going up the chimney—wasting heat and possibly causing damage.

For efficiency, the ashpit may be lined with firebrick and any openings below the grate level closed with fire clay or asbestos cement. Slots or holes in the firing door will admit enough air from above the fuel to supply oxygen for burning. A sliding closure for the slots allows for draft regulation.

Of course, says the Forest Service, the use of seasoned wood only is a "must." Since wood makes only 10 to 20% as much ash as equivalent coal, ash removal is easy. Firebrick can be laid on the ashpit floor to elevate the burning chunks. A narrow ash shovel guided between these bricks will remove as many ashes as necessary.

# Design of Medium Sized Chimneys for Forced Draft

By WILLIAM T. MILLER and NORMAN ARNOLD

Associate Professor of Heating and Ventilating, School of Mechanical Engineering, and Assistant Professor, Department of General Engineering, Purdue University, respectively.

THE accompanying nomographic chart has been designed by the authors to furnish a graphical solution of the formula

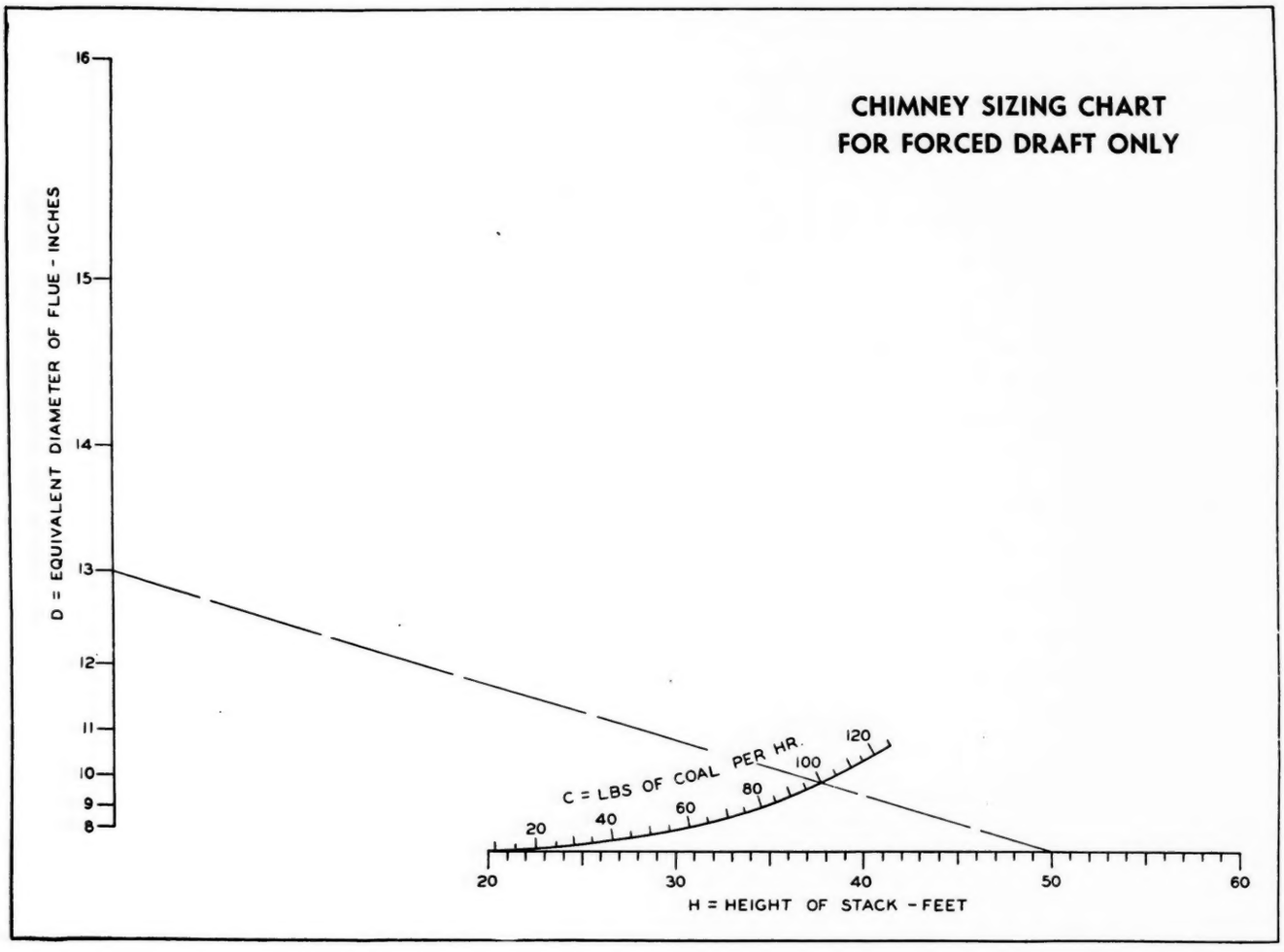
$$D_r = 2.96HB_o\left(\frac{W_o}{T_o} - \frac{W_c}{T_c}\right) - \frac{0.00126W^2T_cfH}{D^5B_oW_c}$$

in which

$D_r$ = the total required draft in inches of water
$H$ = the height of the chimney above the ground in feet
$B_o$ = the barometric pressure corresponding to the altitude in inches of mercury
$W_o$ = the unit weight of a cu ft of air at 0F and sea level pressure, in lb per cu ft
$W_c$ = the unit weight of chimney gases at 0F and sea level pressure, in lb per cu ft
$T_o$ = the absolute temperature of the outside, air, F
$T_c$ = the absolute temperature of the chimney gases, F
$W$ = the weight of gases generated by the boiler and passing through the chimney, in lb per sec.
$f$ = the coefficient of friction
$D$ = the inside diameter of the chimney in feet.

For usual conditions the following values are typical and were assumed:

$B_o$ = 29.92 in. barometric pressure



$W_o$ = 0.0863 lb per cu ft at 0F, air density
$T_o$ = 500F absolute, or 40F, outside air temperature
$W_c$ = 0.090 lb per cu ft, flue gas density
$T_c$ = 760F absolute, or 300F, stack temperature
f = 0.016 coefficient of stack friction.

In addition it was assumed that 20 lb of gas per lb of coal is provided.

After inserting these values in the formula the equation reduces to

$$D_r = H\left(0.00487 - 0.0057\ \frac{W^2}{D^5}\right)$$

It is this formula that has been used to design the accompanying chart. The important assumptions underlying this general equation are:

1. The draft required is not directly proportional to the rate of firing, but a minimum value of 0.05 in. is necessary and the rate increases more slowly than a direct proportion for high rates of firing as given in the I-B-R Rating Code;
2. The static draft of the stack is proportional to the difference in weight of the column of hot gases inside the stack and a column of air the same height;
3. Flue gases within the stack are of uniform density and constant temperature; or, if not, an average value is satisfactory for representation within practical limits; and
4. Head loss due to friction is directly proportional to the height and to the square of the rate of gas flow, and inversely as the fifth power of diameter.

Assumption (1) is undoubtedly quite sound since it is based upon a considerable body of experimental data.

Assumption (2) seems reasonable even for a stack having extreme proportions.

The assumption of uniform density and constant temperature is questionable for an extreme stack, either very high or very short and large in diameter.

The friction loss follows the generally accepted formula used in computing pressure drop in pipes, and seems acceptable.

From the reduced formula and for the selected temperatures and densities, the minimum height stack and minimum diameter stack to provide the draft requirements are greater than the following:

| Firing Rate, C, lb of coal per hr | H, height in ft, cannot be as small as: | Draft, D, in inches, cannot be as small as: |
|---|---|---|
| 20 | 23 | 4.6 |
| 40 | 27 | 7.6 |
| 60 | 31 | 8.0 |
| 80 | 35 | 9.0 |
| 100 | 38 | 9.8 |
| 120 | 41 | 10.5 |

Graphically, these values of H for an indefinite diameter are found by drawing index lines parallel to the D-scale, intersecting it an infinite distance away. Similarly, horizontal index lines (parallel to the H-scale) will give the values of D for infinite height chimneys.

If the draft requirement for a particular fuel or grate is different from the I-B-R rating, or if the coefficients for temperature, density, friction, or barometric pressure are different, these values will be modified.

*Example:* What height of stack is necessary to burn 100 lb of coal per hr if the flue has an equivalent inside diameter of 13 in.? (If the flue is square or rectangular, the chart for equivalent sizes given on page 54 of the September issue of HEATING AND VENTILATING would be used first to obtain the equivalent round diameter.)

*Solution:* Lay a straight edge across the point represented by 13 in. on Scale D and 100 on scale C and the height of the stack is found to be 50 ft on scale H.

There are always an infinite number of solutions for a given case if the quantity of fuel burned per hr is the only factor known. In the above example it will be found, for instance, that a chimney with a 15 in. diameter and a height of 43 ft or one of 12 in. in diameter and a height of 58.7 ft would also satisfy the conditions. This characteristic of the chart is very helpful in the design of a new chimney. Cost estimates may be made for several different sets of values of diameter and height as read from the chart; and the proportions representing minimum cost may be determined.

The problem of modifying an existing chimney to handle an increase in load or a change to coal from some other form of fuel is not quite so flexible of solution because the diameter cannot be increased as readily as the height. The example above represents this situation.

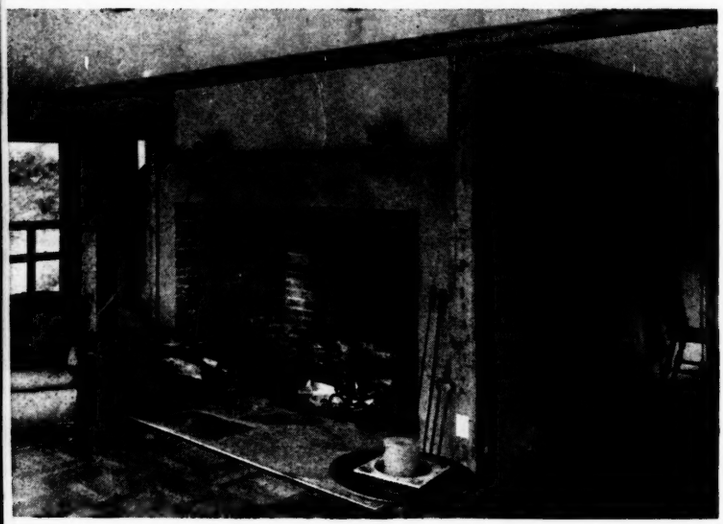
In connection with cost-height-diameter relationships, the following table is believed to represent reasonably closely the limits which will result in economical sizing:

| Firing Rate, C, Lb of Coal per Hr | Limits of D for Minimum Cost, Inches |
|---|---|
| 20 | 5.5 — 8.5 |
| 40 | 8.5 — 11.5 |
| 60 | 10.0 — 13.0 |
| 80 | 11.5 — 14.5 |
| 100 | 13.5 — 16.0 |
| 120 | 14.5 — 17.5 |

It should be noted that this chart applies only to forced draft installations and does not make allowances for the draft required to draw air through the fire bed.

# Radiant Heat Used in Modern

Exterior of Saville R. Davis Home, showing the two large windows and the novel use of cypress instead of clapboards or shingles.



(Above) Fireplace in living room. There is a similar one in the large bedroom directly over this. Back of this chimney is the oil-burner boiler, set in a shallow pit and enclosed in a room just large enough to hold it.

(Below) View of one end of the master bedroom located directly over the living room.

FIFTY-SIX cellarless homes have been built within a short time by Air Conditioned Homes, Inc., in metropolitan Boston. The latest and certainly one of the most unusual of these is the new home of Mr. and Mrs. Saville R. Davis, in Lincoln, Mass. Besides being one of the very few homes in New England heated by the radiant heat method with hot water elements concealed in the floors, this home has several other interesting design features which make it distinctive and unusual. One of these is the large flat roof, which can be flooded to a depth of 2 in. so that excessive heat from the summer sun can be kept out; another is the large expanse of window area and the type of windows used; and a third, the mammoth fireplace with surrounding stairwell and other general interior arrangements.

## Radiant Heating System

Hot water for the floor heating elements is supplied by a General Electric circular type boiler burner. Byers 1½ in. wrought iron pipe was used for the first floor heating, and ¾ in. for the second floor, the circulating hot water traveling first to the outside loops, where needed most, and from there concentrically back to the middle, with no return bends. An extra loop was set under each of the big windows, on both first and second floors. First floor pipe loops are two feet apart and the second floor straight back-and-forth runs are on 16 in. centers. About 500 ft of piping was required for the first floor and 700 ft of ¾ in. piping for the second floor.

Second floor piping is set between the joists, the joists being notched to carry short cross pipes on which the loops rest, with the loops wired to the cross pipes to prevent rattling. First floor piping

Pine-panelled stairway to second floor. Close by is the front entrance with sufficient cool air flow to temper any chance of overheating.

# rn New England Home

was set at the correct elevation above the grade and then a base course of concrete poured to the pipe tops. On this a concrete finish course was laid, covering the pipes. The heater pit, in the center of the house, was made six inches deep.

House temperature is automatically controlled through a room thermostat.

### Flooded Roof

The roof is thoroughly waterproofed, and has a low parapet so that it can be flooded with two inches of water in summer, if desired, to provide insulation against outside heat. Under the roof are 4 in. of rock wool insulation. In addition, there is air space below the roof and above the insulation, with a copper screened vent on each side just below the belt course of exterior finish.

### Fireplace

There is a big central fireplace in the center of the living room, discharging into a brick chimney, and another directly above it in the master bedroom. In fact the house was practically built around the fireplace, with the central heating plant, heating boiler, and accessories located in the enclosure directly behind the fireplace, on the first floor. In other words, the house was planned from the inside out, the owners' idea being to follow their desires for ideal living conditions and to plan the interior rather than, as with most houses, conforming the interior to the exterior architectural plan.

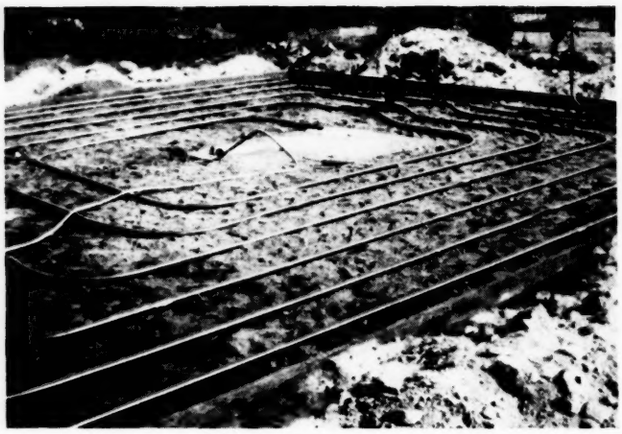
This makes for a unique design, with the big living room dominating the first floor. An important feature of this room, as well as of the master bedroom directly above, is the large expanse of window

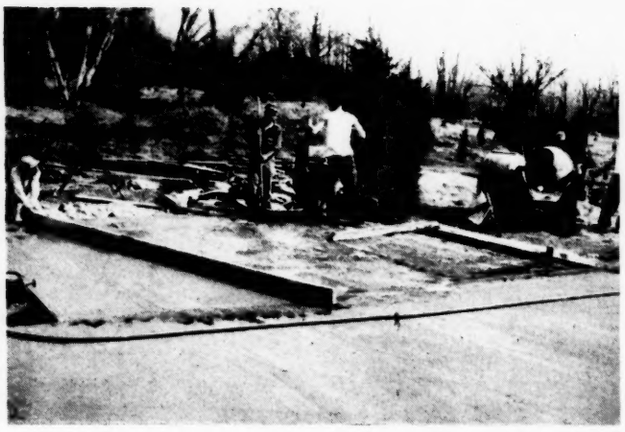
**Section of living room looking out through the large window which is approximately 28 x 7 ft in size.**

**(Above) Looking from the living room into the alcove dining room, with the garden in the background.**

**(Below) General view during construction showing formed and welded hot water pipe loops ready for installation between second floor hoists.**

**Closeup of second floor radiant heating hot water loops. Loops rest down in between the joists on cross-pipes which are set in notches in the joists.**





(Left) First floor piping loops formed and welded and ready to be buried in the concrete floor. Hot water from the boiler, which rests on the boiler pit floor slab shown at the center, circulates outwardly through the concentric loops, then up through the riser to the second floor. (Right) Completing the pouring of the concrete first floor. At the center is the 6 in. boiler pit.

area, which gives a striking view of the surroundings. These rooms are each 32 × 15 ft with a 7 ft 6 in. ceiling in the living room and a 7 ft height in the master bedroom. The windows extend from near the floor to within a few inches of the ceiling, nearly across the length of the room. In addition there are large end windows for the dinette and the master bedroom, with corner windows for other upper rooms.

To the rear of the living room is a small dining room or dinette and off of this a small kitchen, while the front hall also opens directly into the living room. A little back hall connects behind the chimney and heater with the front hall.

Included in the layout are two other sizable bedrooms on the second floor, one of them a specially planned child's bedroom, and bath, with a maid's room and bath, utility room and general supply room downstairs. The living room fireplace has a flagstone hearth, with slate grey outer walls, and is almost high enough for a 6-ft man to stand in.

The house should be quite cool in summer, despite the two giant windows through which the sun will be pouring most of the day, for, besides the cross-ventilation afforded by the front door and a French door opposite, opening out to the terrace, there is a ventilator set above the fireplace in the living room, above the mantle, with a grille that is practically invisible. Opposite this is another grille, on the back hall side of the flue, into which both open, serving to let out warm air from both sides of the house, when the temperature runs too high. Radiators are provided for, also, in winter if needed, connected to the floor panels, in the maid's room, the back hallway and the child's bedroom.

Because of the beautiful grain structure, random cypress boards, treated to give a reddish tinge, were used for the exterior finish of the house, the upper courses being applied horizontally and the lower ones vertically. This, together with a semi-circular canopy built over the front door, the tall cedars planted close against the walls, and the winding paths and flagstone terraces, tends to break the somewhat severe lines.

General contractor and builder was H. Whittemore Brown, Air Conditioned Homes, Inc. The heating and plumbing were installed by Martin Coffey & Sons.

## Keep Baffles Tight

One subject that is seldom touched upon in connection with boiler management is the baffle wall. A baffle seems to be a very simple part of a boiler setting and therefore worthy of but little thought, but that is not the case. Baffles should be correctly designed, correctly placed in the boiler tubes, and they should be leakless. Tests have proved that they cannot be placed haphazard here and there. The volume of the hottest gases usually determines the position of the first baffle encountered. Then, as the gases reduce in volume, due to coming in contact with the tubes and giving off heat, it is clear that the second baffle must be so placed that there will be no reduction in gas velocity, and so on. As the gas moves from pass to pass the baffles are placed closer and closer together.

If the baffles leak because of loose or careless construction, the hot gas will short circuit through the baffle and escape up the chimney without giving off the full amount of heat. The chimney gases will be too hot. Holes in baffles should be stopped up with a good grade of plastic firebrick. Or, where the baffle is in a tumble-down condition, it is well to replace the entire baffle with a new one of plastic composition with corrugated metal separators between layers. These separators furnish positive expansion joints and they do not permit leakage.—*W. F. Schaphorst*

# PROFITS IN AIR

## HOW INDUSTRIAL PLANTS PROMOTE PROCESSES BY CONTROL OF AIR CONDITIONS

Photograph courtesy of Albert Kahn Associated Architects and Engineers, Inc., and Glenn L. Martin Company.

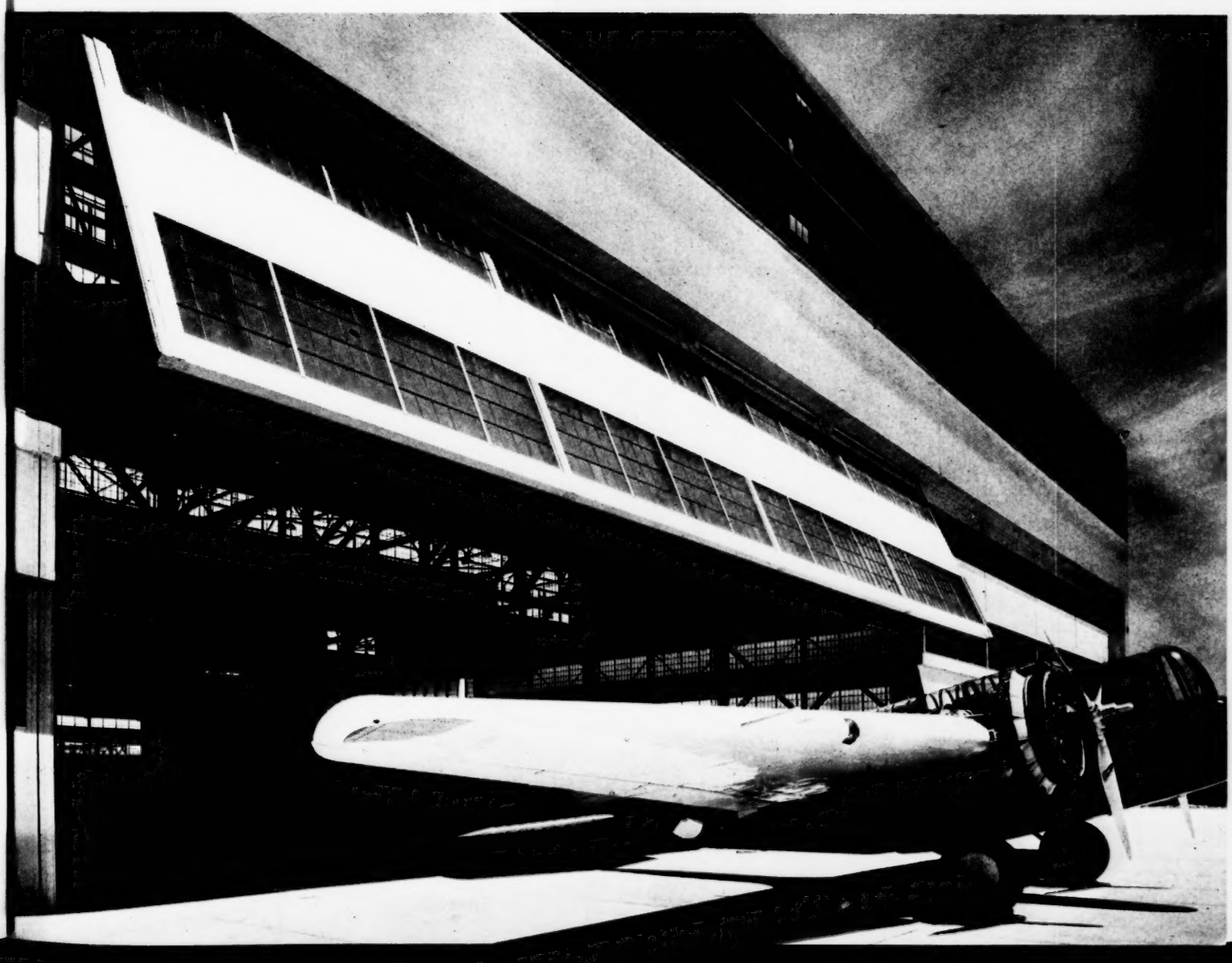


Fig. 1. View of the Axelson Manufacturing Company's air conditioned gage room. Overhead in the center is the main supply duct with diffuser outlets shown.

# AXELSON MANUFACTURING CO.

PROFITS IN AIR
HOW INDUSTRIAL PLANTS PROMOTE PROCESSES BY CONTROL OF AIR CONDITIONS

**produces gages and close-fitting machine parts for war work in air conditioned room. Accurate temperature and humidity control permit working to small tolerances.**

By CHARLES O. HERB†

MEN experienced in the machining, inspection and assembly of metal parts that must meet close dimensional tolerances are well aware of the troublesome situations which may arise from finishing a part at a certain room temperature and checking or assembling the part at an appreciably higher or lower temperature. If the part is made of brass, aluminum or cast iron, for example, there will be a considerable difference between the expansion or contraction of the work and that of the alloy steel gage employed for its inspection, or of parts of other metals into which it is to be assembled.

## Gages and Temperature

Gage manufacturers have always been acquainted with these vagaries of metal, and for this reason most important gage manufacturers perform finishing operations on their products in departments that are maintained at a constant temperature the year round. Thus a gage made in one of these rooms to a specified dimension on the coldest day in January will be of exactly the same dimension as a similar gage finished on the hottest day in July, and not several ten-thousandths of an inch larger.

The Axelson Manufacturing Company, Los Angeles, California, has for years produced many types of gages necessary for the interchangeable manufacture of oil pumps and other oil field equipment, as well as gages required in the building of heavy duty engine lathes. On the basis of this experience the concern was able to accept large contracts from our own government and others of the United Nations for gages required in the manufacture of war munitions.

†Managing Editor, MACHINERY.

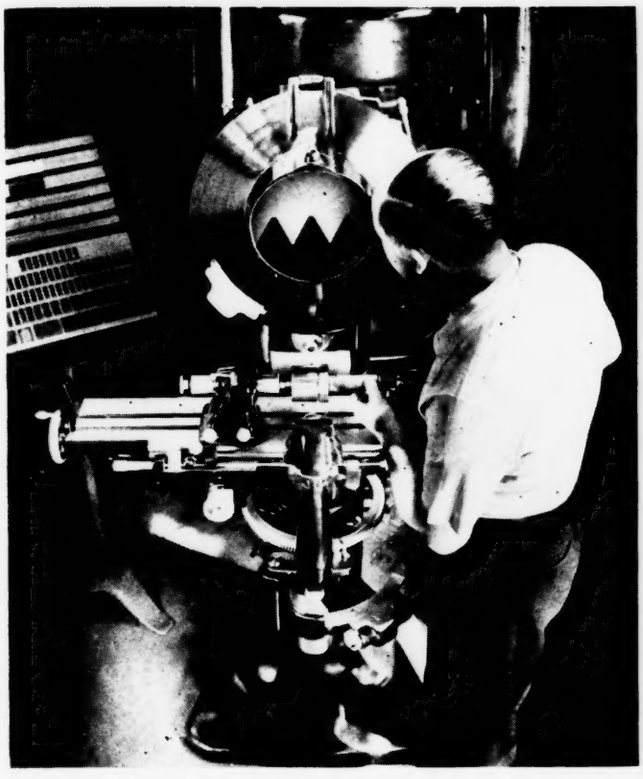


**Fig. 2. A Jones & Lamson comparator is used to inspect the thread form on gages and to expose minute defects.**

## Air Conditioning

The large gage volume going through the shop warranted the construction of a separate air conditioned gage room comparable to those of plants devoted exclusively to gage manufacture. Thread gages are made in this department with threads as small as Number 10—thirty-two per inch; and as large as 10¼ inches diameter—6 threads per inch. Threads as coarse as 12 per inch are ground from the solid, while coarser threads are pre-cut, usually by chasing, before being hardened and are afterward finished by grinding. All grinding and checking operations on gages are performed in this air conditioned room, and in addition all lead screws for Axelson engine lathes are threadmilled in this department to insure the highest possible accuracy. The room is 70 ft long by 30 ft wide. It is the largest air conditioned room on the Pacific Coast in use for the specific purpose mentioned. The height from the floor to the ceiling is 10 ft. The temperature in this room is maintained at 68F within plus or minus 1 degree the entire year round. The humidity is also controlled to never exceed 50%.

Such close control is essential because on a 6 in. thread gage, for example, a difference in room temperature of only 7½ degrees would cause the gage to expand or contract more than the specified tolerance of 0.0003 in. On thick, solid parts the expansion or contraction would, of course, not be as great as on gages designed with thin webs and lightening holes.

Conditioned air is constantly delivered through a duct that extends along the ceiling in the middle of the room, as seen in the heading illustration, and discharged through three draftless air diffusers. Outgoing air is discharged through a grill in the wall at one end of the room. A thermostat located in this outgoing air stream controls the operation of the

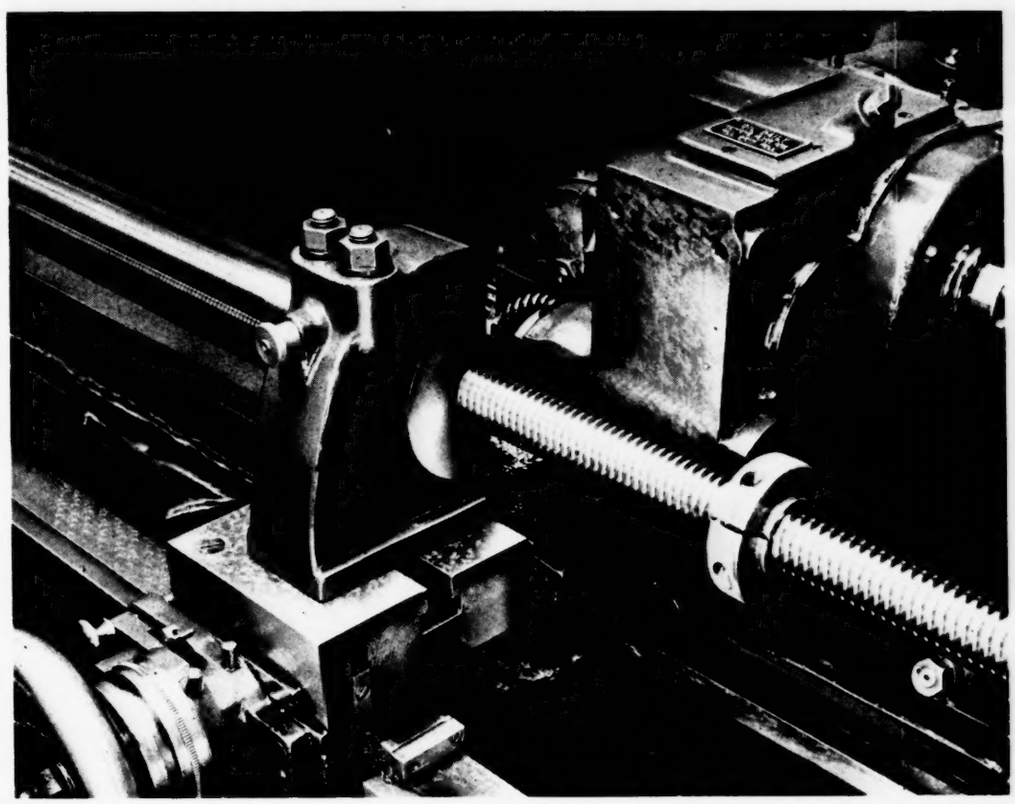


**Fig. 3. Lead screws for engine lathes are thread milled in the air conditioned room accurate as to lead within 0.0003 in. in 2 in. at any point along the screw**

air conditioning system as required to maintain the prescribed temperature. The cooling load handled by the system varies somewhat and consists of the heat liberated by machinery and motors, by lights, and by the occupants of the room, plus the usual transmission losses and the latent and sensible requirements of the make-up air. Of these, only the lighting is nearly constant. There is a complete change of the air in the room every three minutes. Double doors are provided at the room entrance to minimize local temperature and humidity disturbances due to air coming in from the outside with the opening and closing of the doors. A record of the room temperature at all times is kept by a Foxboro temperature recorder.

The cooling of the air is effected by a 25 ton compressor, using Freon as refrigerant. The air conditioning equipment was installed by the Carrier Corporation.

**Room Construction**

This conditioned room is completely enclosed by insulated, windowless walls so as to prevent the room temperature from being affected by the hot rays of the sun, and thus to reduce operating costs of the air conditioning system. Light is provided by over 600 General Electric fluorescent tubes of 40 watts each which are arranged in three metal reflectors that extend along the ceiling the full length of the room on both sides and in the middle. The light at bench height is equal to 50 foot-candles.

Tubes of different colors were installed to aid in discovering defects in work pieces. For example, "day light" and white tubes are installed alongside of each other and alternated from one end of the reflectors to the other. These tubes are interspersed at several points with green tubes, and with blue tubes at still another point. With this arrangement, work can be tilted in the hands of the inspectors so that a green or blue band of light will be imposed on the part and any defects quickly shown up where the reflected color meets the normal reflection on the work piece. Artificial lighting ordinarily avoids strong shadows, but these shadows, or color shadings, are a distinct advantage in the inspection operations.

## Flying Suits

**are stored between flights in alternately cooled and heated rooms to kill moth larva.**

A periodic cycle of cooling and heating is proving to be the best method of protecting expensive wool-and-fur flying suits from moths while they are stored between flights. Due to their frequent use, chemical treatment is not satisfactory and may even damage the furs.

The normal storage temperature is 35 to 40F. In the "shock" cycle, the storage room temperature is reduced to 15F for several days to kill any larva which may be feeding. Then, by cutting off the refrigeration and introducing heat (usually from strip heaters in the supply duct or coil chamber), the storage room temperature is quickly raised to 50F where it is held for a few hours only. This causes any surviving larva to again become active and will hatch out any likewise potentially dangerous eggs.

The temperature, after this few hour period at 50F, is again suddenly dropped to 15F for a day to kill off the surviving larva and any larva newly hatched. After one day at 15F the temperature is brought back to the 35F or 40F storage condition.

This entire procedure is repeated at regular intervals or, to prevent reinfestation, when any appreciable quantity of untreated articles of clothing is placed in the storage room. Relative humidity is high enough to prevent drying and cracking of the fur skin, but low enough to prevent mould or mildew. During the normal storage period with temperatures of 35 to 40F, the relative humidity ranges from 50 to 65%.

Typical installations include a flying school using an open-type 7½ hp condensing unit with 2-speed motor, and a horizontal type air handling unit with refrigeration coil.

At one typical aircraft factory three 25 hp condensing units, four air handling units with refrigeration coils are used.—*L. W. Clifford, Westinghouse Electric & Manufacturing Co., East Springfield, Mass.*

## Sperry Gyroscope Co.

**installs odor adsorbers to treat recirculated air.**

In one building of the new Sperry Gyroscope Company plant seven hundred Dorex adsorber canisters have been installed in the air conditioned company cafeteria to treat 20,000 cfm of return air.

By making recirculation possible, use of this equipment has led to the conservation of 50 tons of installed refrigeration, and will later result in saving approximately 45,000 kw-hr of electric current per season for cooling purposes, and approximately 40,000 gallons of oil per season for heating.

Engineering of the Sperry plant was by Stone & Webster Engineering Corp., Boston.

# When Can the Heating Contractor Collect for Extras?

By LEO T. PARKER

Attorney-at-Law, Cincinnati, Ohio.

TO assure successful and profitable conduct of a heating contracting business, it is necessary that the contract be ultimately profitable; this means that avoidance of financial losses is necessary. This brings us to a discussion of "extras"—a source of much trouble between contractors and owners.

The purpose of this article, then, is to explain how heating contractors may avoid losses, as determined by recent higher court decisions involving various phases of the law on collection for extras.

First, it is important to know that a contractor cannot recover payment for extras unless the higher court may decide that the owner either impliedly or expressly agreed to such extra payments. This is a broad statement of law but dependable.

For illustration, in the leading case of Cobb v. Bond, it was disclosed that a contractor and an owner entered into a contract which provided that an engineer was privileged to alter the heating equipment plans, as the work progressed. After the contractor has started work the engineer altered the original plans. The contractor was compelled to expend a considerable sum for extras. He sued the owner to collect a reasonable sum in addition to the contract price. However, the higher court refused to hold in favor of the contractor, and said:

"It was provided in the contract that the engineer had the right, as the work progressed, to alter the plans, and that his decision thereon was final. It follows, therefore, that when the contract was signed, the contractor *knew* that the plans could be changed, and he knew, or should have known, that such alterations would probably increase the cost. He could have provided in the contract that if the alterations in the plans increased the cost he should receive additional compensation. He did not do so, however, and he is bound by the express terms of the written contract executed by him."

Obviously, therefore, all contractors should include a clause in contracts, as follows:

"Irrespective of other clauses and provisions in the agreement it is mutually agreed between the owner and the contractor, that said contractor shall receive reasonable payment, in addition to that provided in this contract, for extra materials and labor supplied by authorization of the owner or his agent."

*"A contractor cannot recover payment for extras unless the owner agreed."*

With this clause included in a heating contract, contractors have reasonable assurance that when either an owner or his representative (engineer, architect, or employe) orders extra work and materials, the owner automatically becomes obligated to pay a reasonable additional sum for such extras. Of course, it is true that many owners object to including a clause of this nature in the contract; if so the contractor must rely upon the usual law explained herein relating to construction and installation contracts.

Ordinarily, a written contract cannot be altered or varied by a verbal agreement, provided the written instrument expresses the complete contract between the parties. However, where both a written instrument and the oral agreement are necessary to *complete* the contract, both the written and the oral portions are considered by the courts as the true agreements when deciding a controversy involving the rights and liabilities of the parties.

However, a valid written contract, which clearly expresses the intentions of the contracting parties, cannot be altered or varied by oral or *side* agreements, because this practice would enable all persons to easily avoid obligations of a written contract by introduction of testimony tending to prove that the legal effect of such obligations was changed by a subsequent verbal agreement.

Irrespective of the law pertaining to written and verbal agreements a contractor must comply with the terms of the written contract which are favorable to the owner. Failure to do so renders the contractor liable although it may appear unnecessary for the contractor to comply with the precise terms of the contract.

For example, in Trust Co. v. Willis, it was shown that a contract contained the following clause:

"Upon order of the architect, all work may be suspended for any substantial cause, such as unfavorable weather conditions, etc. The decision of the engineer shall be final and binding in all questions relating to additional, omitted or changed work."

Unusually bad weather prevented the contractor from completing without delay certain ex-

tras ordered by the engineer. Since the contractor had ceased work on account of the bad weather, and without obtaining consent of the architect, the higher court indicated liability on the part of the contractor, and said:

"Many building and construction contracts endeavor to give the architect in charge of the work certain powers over it, and such contracts have frequently been before the courts for construction. The weight of authority is to the effect that such contracts are valid and binding on the parties according to their terms."

### Written Authority

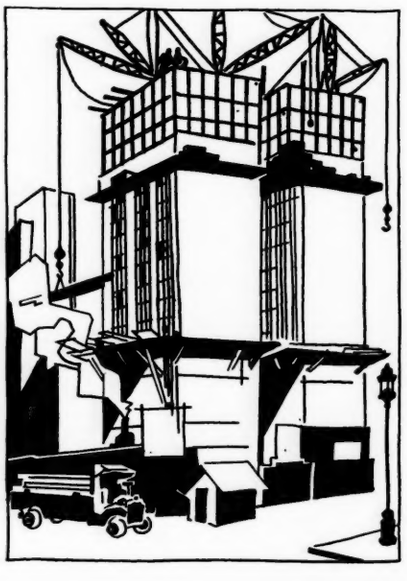
Some few courts (higher courts disagree) have strictly upheld the law pertaining to written authority for extra work, but a majority of courts have refused to penalize the contractor with unfair benefits to the owner. The following higher court cases illustrate this point of law.

In Guizzette v. Katrek, it was shown that an owner and a contractor entered into a contract by the terms of which no alterations or extra work should be performed without a written order from the owner or his representative and an express agreement in writing as to the cost.

The contractor performed extra work under a verbal agreement with the owner who in this agreement verbally promised to pay the contractor a specified sum for the extra work. After the job was completed the owner refused to pay for the extra work and the contractor filed suit. In holding the owner not liable for payment, the court said:

"When a contract provides in substance that no addition or alterations made during the progress of the work shall be regarded as extra work unless agreed to in writing and signed by the parties before such extra work is begun, the performance of extra work without such written agreement will not give rise to an implied waiver of the provisions on the part of the owner in the respect."

In other words, this court, in effect, held that contractors are not entitled to collect extra payments for extras unless the terms of the written contract are strictly followed, and this notwithstanding the fact that the contractor may have performed the work in compliance with instructions or demands of the owner who was financially benefited at the sole expense of and detriment to the contractor. However, it is important to know that the courts in a majority of states have established the law that, although a construction contract clearly stipulates that all extra work not included in the original specification shall be ordered in writing, yet the owner is liable for payment for the extra work performed by a heating contractor if it is shown that the contractor was verbally ordered to perform the work by the owner or properly authorized persons.



For instance, in Caus v. Board, it was shown that a contractor and an owner entered into a contract which contained a provision that all extra work must be ordered in writing. However, in violation of this part of the contract, certain extra work was verbally ordered by the owner's representative.

When payment for the extra work was refused the contractor filed suit. In holding the owner liable for full payment, the court said:

"The objections are to charges for extra work. The contract provides that there should be no allowances for extras unless authorized in writing. All extras were verbally ordered by the superintendent on the job. The authority of the superintendent to order the extras was not only inherent in his position, but it was also recognized."

Nevertheless, since the higher courts are not in accord on this point of law, heating contractors should safeguard themselves against financial losses from this source and, under all circumstances, comply with the terms of the contract. If the contract requires that extras shall be ordered in writing, the contractor should refuse to perform extra work and supply additional materials unless the owner orders the same in writing with a stipulated additional price agreed upon.

### Owner Admits Liability

Various higher courts have held that an owner has the privilege of admitting liability and of paying the heating contractor for the full value of extra work and materials. It is important to know that an owner who accepts the *job* automatically admits these facts.

In the case of Collins v. Hall, the facts were that a contractor performed extra work on a job. The court held that it was automatically admitted by the owner (1) that the contractor had not in any manner breached his contract; (2) but that he had only substantially complied *with the contract;* (3) and that the changes, alterations and additions were made at the request of the owner, and were not provided for in the plans and specifications. However, the owner accepted the job as completed, and entered into possession. In holding the owner liable for full payment of all extras the higher court said:

"Extra work, for which a contractor is entitled to additional compensation, and for materials and labor, are such as are not 'contemplated by the contract, but which are required changes in the

plans and specifications made after the contract has been entered into. . . .' The changes and additions made at the request of the owner after the contract was made and construction had begun were clearly not provided for nor contemplated in the contract itself, but they were manifestly 'connected with the subject matter of the contract' and not foreign to it."

### Contracts with Tenant

Obviously, a heating contractor always has difficulties and assumes considerable risk when accepting a contract for performance of work, unless he searches the court records to determine for certain who owns the building on which work is to be performed. But there are certain well defined circumstances under which the building owner is liable for payment, athough the tenant, or others, contract with the contractor. This is important law, a knowledge of which on occasion may save contractors financial losses.

In Monnig Heating Company v. Eastom, the owner of a building leased it to a tenant under a lease contract which contained a clause to the effect that should replacement become necessary through ordinary wear and tear, the owner agreed to repair or replace the same.

The old heating plant was a warm air system, and in a brick room built adjacent to the building proper. The tenant began to complain to the owner that the heating plant had become inadequate and would have to be replaced. The owner failed to install a new heating system, and the tenant became discouraged and contracted with a heating company to install a modern steam-heating plant.

The higher court held the owner bound to pay the full cost of installing the new plant, and said:

"The court finds from the evidence in this case that the heating plant which was in the premises at the time of the making of the lease thereafter became inadequate to heat the premises through ordinary wear and tear. Not only was there abundant testimony that cracks had developed in the fire boxes above the fuel level, which had the same effect as dampers, and materially interfered with the efficiency of the plant, but that the entire system had deteriorated to the point where it was more expensive to repair it than to install a new plant."

This higher court case establishes the law that where an owner is impliedly or expressly obligated to make repairs, the contractor can proceed on the authority of the tenant and collect payment from the owner.

The reason for this unusual law is the fact that when the owner contracts to do something, as maintain the heating plant in good condition, this means that he is legally obligated to do so. If he refuses the other party may proceed to do that which the owner promised to do and then sue and collect from the owner. Therefore since the owner was, in the above mentioned case, obligated to install a new heating plant, the court held that since the contractor had, through authority of the tenant, performed work for which the tenant was obligated to pay, there was no reason why the contractor should not receive payment directly from the owner instead of the owner paying the contractor and then suing and recovering from the owner.

The important point of law, however, to be considered is: Although the contractor may recover payment for work performed by authority of the tenant, when the owner is obligated to do the job, yet the contractor cannot recover from the owner for extras but he must recover payment for such extras from the tenant. This is so because the owner is not obligated to the tenant to supply more than the materials and labor specified in the contract between the owner and the tenant.

Still another important element of law is this: If, for example, a tenant rents a building that is assumed to be in good condition and later it is not reasonably fit for the intended uses of the tenant, the latter may make the necessary repairs and compel the owner to pay for same. This law was established recently when the tenant notified the owner that his roof was leaking, and as the owner did not repair the roof the tenant contracted for the work; it was held that the owner was not being imposed upon when the cost of the repairs was charged to him. In other words, the law requires that the landlord shall maintain rented premises in reasonably good condition for the intended purposes of the lessee. His failure to comply with this implied agreement entitles the tenant to make the repairs and send the bill to the landlord. But, again, the latter never is obligated to pay for extras.

## Parachutes for Air Corps Protected by Air Conditioning

Parachutes of the U. S. Army and Navy are being protected against mildewing and rotting by modern air conditioning and ventilation while being kept in storage.

Excess moisture in parachute storage rooms, it was found, affected materials in the parachutes while they were packed away awaiting use. To remove this moisture and keep temperatures and humidities in the storage rooms constant, air conditioning units were installed at other naval stations and bases throughout the South.

Five dehumidification units were installed recently at the Naval Air Station at Corpus Christi. Each unit is capable of removing approximately 7 lb of moisture per hour from the air when the temperature reaches 85F and relative humidity stands at 48%. — *Edward T. Murphy, Vice-President, Carrier Corporation.*

# What the Ventilating Engineer Should Know About Carbon Tetrachloride

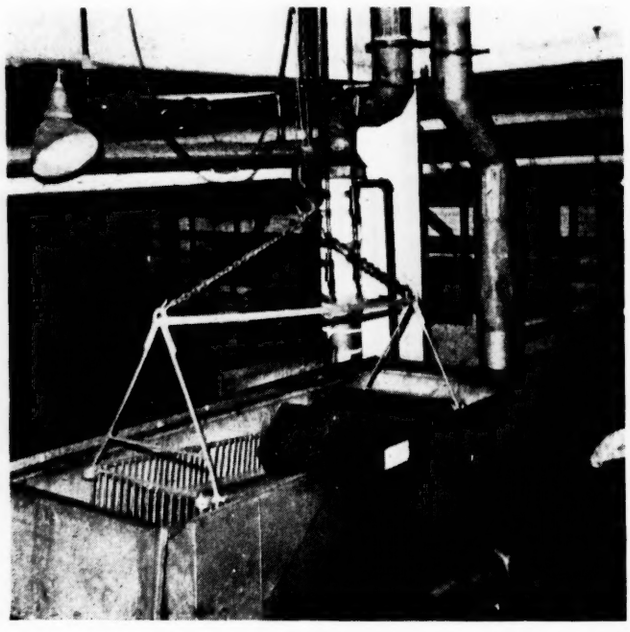
By H. P. QUADLAND

Safety Research Institute

UNTIL comparatively recent years, carbon tetrachloride was regarded as harmless to humans in non-narcotic concentrations, and, having the added safety factor of being free from fire and explosion hazards, it was handled without efficient ventilation and other precautions in many establishments. This is no longer the practice, but even before protective measures were introduced, serious cases of poisoning were rare. Today, they are usually the result of abnormal exposures due to carelessness or ignorance.

Production of carbon tetrachloride has more than tripled in the past ten years, amounting to 100,811,000 lb in 1940, the latest year for which statistics are available. In industry, the chemical has wide application as a solvent and degreaser. Some of the industries in which carbon tetrachloride plays its part are: chemical, leather, textile, metal, paint and lacquer, dry cleaning, airplane, ordnance, plastics, rubber, printing, dental supply, and perfumery.

Probably the chief method of preparing carbon tetrachloride commercially in this country is by causing a chemical reaction to take place between sulphur chloride and carbon bisulphide. By permitting chlorine gas to react with sulphur, the product sulphur chloride is obtained. The carbon bisulphide is made from charcoal and sulphur, the reaction taking place at fairly high temperatures. The carbon tetrachloride formed from these two liquids is then purified by fractional distillation.



*An industrial degreasing unit approved for use with carbon tetrachloride. This is one of many different types of such machines.*

## Properties

Carbon tetrachloride, $CCl_4$, is a clear, colorless, heavy liquid with an odor similar to chloroform. Non-inflammable and non-explosive, it will not support combustion, which is a safety factor of the utmost importance.

It has great avidity for mineral oils, fats and waxes, and dissolves a variety of organic compounds, including rubber, certain gums, resins and plastics.

Physical properties of the chemical that are of interest include the following:

| | |
|---|---|
| Molecular weight | = 153.828 |
| Specific gravity at 77F to 39F (Water = 1) | = 1.5845 |
| Temp. correction for sp. gr. | = .0011 per 1F |
| Weight per gallon at 77F | = 13.22 pounds |
| Weight per cu ft at 77F | = 98.92 pounds |
| Vapor density (Air = 1) | = 5.32 |
| Wt per cu ft of vapor at 170F | = 0.335 pounds |
| Freezing point | = —11F |
| Boiling point at 29.92 in. mercury | = 170F |
| Heat of vaporization | = 87 Btu per lb |
| Flash point | None |
| Fire point | None |
| Dielectric constant, 1,000 cycle | 2.24 |
| Power factor, 1,000 cycle | 0.057% |
| Thermal expansion per F | 0.071% |
| Solubility in water at 68F (lb per 100 lb water) | 0.08 |
| Vapor pressure at 32F | 1.31 in. mercury |

Only when moisture is present does corrosion of certain metals become a problem in degreasing and other equipment in which this chemical is used. The problem is reduced to a minimum by constructing the apparatus of selected metals. In the order of preference, these metals are: nickel, monel, 18-8 stainless steel containing 2-4% molybdenum, lead, tin, well-tinned copper, galvanized iron, and copper.

Some of the occupations in which contact with carbon tetrachloride occurs are, according to U. S. Public Health Bulletin No. 259, as follows: assemblers and cleaners (foundries); blockers and hatters (hat industry); builders, mill men, cementers and vulcanizers (rubber industry); burnishers (metals); cleaners of metal parts (metal and other industries); cleaners and degreasers of hides and leather; cleaners of type and plates (printing industry); dental technicians (dental supplies); dye makers; electroplaters; fire extinguisher makers; lacquerers; mechanics (garage); metal-polish makers; operators,

spotters, finishers, etc. (dry-cleaning industry); painters and paint makers; pharmacists (patent medicine, drugs); perfume makers; polish makers; shoe factory workers; and washmen and degreasers (textile industry).

As in dealing with any chemical agent foreign to body constitution and functioning, precautions must be taken to avoid prolonged contact of liquid carbon tetrachloride with the hands or body. The Carbon Tetrachloride Producers Technical Committee states:

"While there is no positive evidence of carbon tetrachloride being absorbed into the system through contact with the skin, it is best to prevent prolonged or unnecessary contact with the hands or body surfaces. Because of its great oil-dissolving properties, such prolonged contact is liable to leave the skin harsh, dry and subject to chapping or cracking and thus possibly leading to discomfort or infection."

Carbon tetrachloride presents less of a health hazard than a number of other commonly used solvents, because of the difference in after-effects; nevertheless, if the exposure is severe enough, temporary or permanent impairment of health may ensue. Individual susceptibility is an important factor, as with any other solvent. However, with proper precautions the chemical can be used with complete safety.

In a minor case of carbon tetrachloride poisoning, immediate symptoms are headache, dizziness, nausea and intestinal pain. In a severe case of exposure, damage to liver and kidneys may develop. In unusually severe cases, the kidneys may cease to function and death may result from accumulation in the blood of constituents that should have been eliminated in the urine. With proper medical care, however, recovery is generally a matter of a few weeks. As Sappington has said, in *Medicolegal Phases of Occupational Diseases*, "Because of the ability of liver cells to regenerate rapidly, permanent disability from this type of poisoning is uncommon."

### Maximum Allowable Concentration

Extensive studies have been made as to the maximum allowable concentration of carbon tetrachloride vapors in the atmosphere. Smyth, H. F., et al. on the basis of animal experiments and detailed medical examination of a large number of workers in operations involving the chemical, concluded that "100 parts per million of air of carbon tetrachloride vapors is a safe concentration for continuous exposure of workmen throughout the day, and day by day." He considers 1,000 ppm safe for ½ hr exposure if the day's average is not more than 100 ppm.

As an industrial safety standard, the 100 ppm maximum for constant exposure has been generally accepted. It has been recommended in various codes and been concurred in by leading toxicologists.

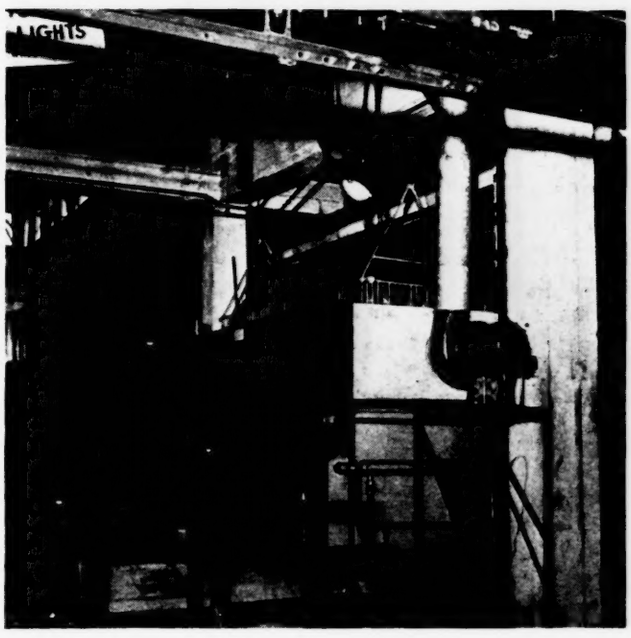
The concentration of carbon tetrachloride vapors in the atmosphere is determined by various methods established through research and experimentation. The method developed by Olsen, Smyth, Ferguson and Cheflan is based upon the observation that carbon tetrachloride vapor mixed with moist air is decomposed quantitatively into hydrogen chloride when passed through a silica tube heated to 1830 to 2000F. By absorption and determination of the hydrogen chloride the concentration of the carbon tetrachloride vapor is calculated.

Fieldner, Katz, Kinney and Longfellow found the concentration of vaporized carbon tetrachloride in air by drying the sample over calcium chloride and soda lime, absorbing the organic vapor with activated charcoal, and finding the increase in weight, making suitable deductions for the presence of inorganic halogen compounds.

In Massachusetts the carbon tetrachloride vapors are determined by absorption in amyl acetate and then burning the solution in a modified sulphur lamp apparatus. In New York State, the portable equipment described by Tebbins is used.

Prevention of exposure to carbon tetrachloride vapors depends upon the type of process involved and adequate ventilation. Specially designed hoods, tanks, and general exhaust ventilation of the downdraft type that carry the heavier-than-air vapors away from the breathing zone of the operator are necessary. The vapors are exhausted at floor level and precautions are taken to prevent them from returning through open windows once they are driven outside. Re-circulation of the air in the workroom must be avoided as it tends to build up the vapors.

In many of the cleaning and degreasing operations in industrial plants, enclosed systems are used which prevent accumulations of vapors in the workroom, and such systems are preferred. Ventilation of tanks used for solvent cleaning has been described by Hatch (HEATING AND VENTILATING, October, 1940) and by Harris (HEATING AND VENTILATING, July, 1942).




*The ventilating equipment exhausts the vapors of the solvent and prevents their dispersal in sufficient concentration to affect employees.*

# How to Design Exhaust Hoods

By J. M. DALLA VALLE
Engineer and Consultant, Kruse Engineering Co., Newark, N. J.

## PART I—THEORY OF FLOW INTO AN OPENING

**Surprisingly little information in printed form has been available on the design of hoods for use with local exhaust ventilation of industrial dusts, fumes, vapors and gases. In view of this, J. M. Dalla Valle, some years ago privately published a booklet on hood design. This book, now out of print, has been thoroughly revised by Mr. Dalla Valle during the last few months, and will appear serially in HEATING AND VENTILATING during 1943, the accompanying article being the first installment of the series. The fundamental principles will first be reviewed, followed by practical examples of hood design, so arranged as to develop a hood classification by type and functions so that basic designs presented will have a general application to similar problems.**

MOST studies concerned with control of occupational diseases caused by dusts, fumes, vapors, and gases have recognized the value of local exhaust ventilation. The effectiveness of this control method depends upon the design of a suitable hood or opening placed near the source of the hazard. The hood, maintained under suction, creates an air movement which conveys the hazardous material into it and thence through a duct system to a suitable point of disposal. As may be expected, the design of the hood, its velocity characteristics, and its proper location with respect to the hazard source are matters of great importance to the control engineer. Unfortunately, little attention has been given to the design of exhaust hoods, and except for two or three instances, where some research work has been done, there is a surprising lack of data pertaining to their requirements and design. Hoods have been constructed and installed without any certainty that they would perform as expected.

Any hood design is complicated chiefly by the fact that operating requirements vary tremendously, ranging from possible complete enclosure of the point of dust generation to an exhaust hood operated independently of a moving cutting tool, with the least possible interference in the manufacturing process. This is well illustrated by comparing rock-drilling operations (where the point of dust generation may be completely enclosed) with those involved in the operation of the hand-pneumatic granite carving tool to which no direct attachment can be made. In the latter case, the tool is moved about over the stone at will and no provision is made to move the hood in conjunction with it.

An approach to hood design problems which is both extremely powerful and useful has recently been made.[1] Obviously, if the velocity characteristics of hoods are available, an approximate idea of the hood performance can be gained. It is from such data that the designing engineer can foretell what to expect of a particular hood with a given flow of air. This procedure would be far better than the mere statement that so many "inches of suction" are required; of course, the latter term is convenient, but it does not express the "reaching-out" qualities of a hood which are so important.

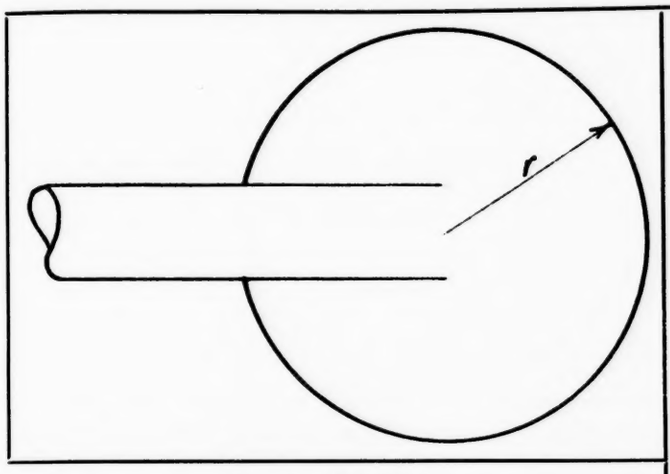
It is well known that the air velocities in the region in front of an opening under suction change rapidly. To obtain an approximate relation between air speed and distance, consider a small opening under suction surrounded by an imaginary sphere of radius $r$, as shown in Fig. 1. It is clear that all the air entering the opening must pass through the surface of the sphere, except at the region cutting the opening which may be considered small in comparison. If the amount of air flowing is represented by $Q$, then the velocity along the surface of the sphere will be given by the equation $V = Q/A$, where $A$ is the surface of the sphere. However, from elementary geometry the value of $A$ is equal to $4\pi r^2$. Hence,

$$V = \frac{Q}{4\pi r^2} = 0.079\frac{Q}{r^2} \qquad (1)$$

The relation indicates that the velocity at any point on the surface of the sphere is proportional to the volume flowing and inversely proportional to the square of the distance from the opening.

Openings under suction may be regarded as low pressure areas toward which air moves from all directions. If the actual distribution of velocities were ascertained and drawn for a circular opening in a diametrical plane, it would be of the shape indicated in Fig. 2. The curves marked A, B, C, etc. are known as equal velocity curves; that is, every point on the curve represents a constant velocity. The curves 1, 2, 3, etc., drawn so as to be perpendicular at the points of intersection with the velocity contours, are

[1] Dalla Valle, J. M., and Hatch, Theodore, 1932: Studies in the Design of Local Exhaust Hoods, *Trans. A.S.M.E. 54:* 31-37.



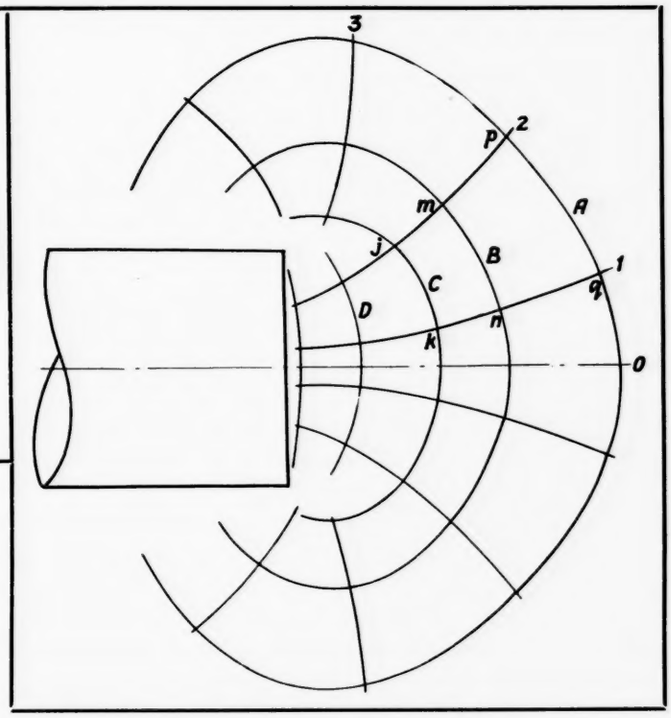




Fig. 1. (Above)
Fig. 2. (Right)

called stream lines (or lines whose tangent at any point indicates the direction of air flow). Obviously, the total flow between two such curves is constant, the convergence of the curves indicating an increased velocity toward the opening.

Some difficulty arises in extending the two-dimensional flow figure to three dimensions. From the symmetry of a circular opening it is easily seen that the velocity conditions shown in Fig. 2 are the same in any other diametrical plane. The rotation of the plane about the axis generates surfaces of equal velocity and tubular sheets of flow. Thus, the velocity and streamline distributions in a single radial plane of a circular opening represent the velocity conditions existing throughout the sphere of influence of the opening. On the other hand, for rectangular openings, the procedure is more intricate and practically impossible to represent in two-dimensional figures.

However, a fair approximation of conditions is deductible if the contours are mapped in two radial planes perpendicular to the sides, as shown in Fig. 3. In the case of square openings, the contours in each of the planes are identical.

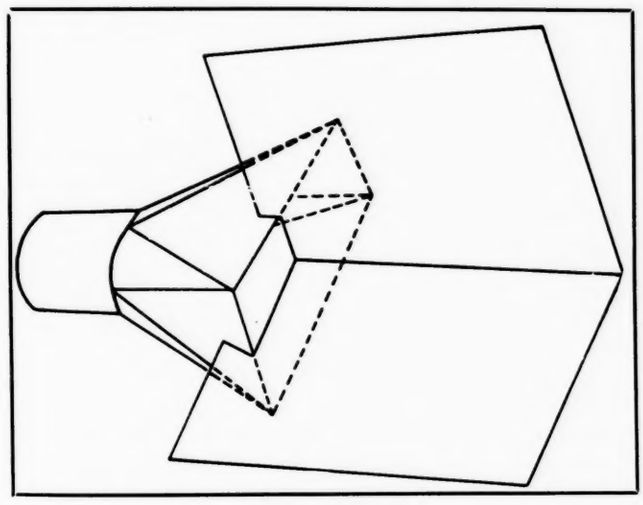
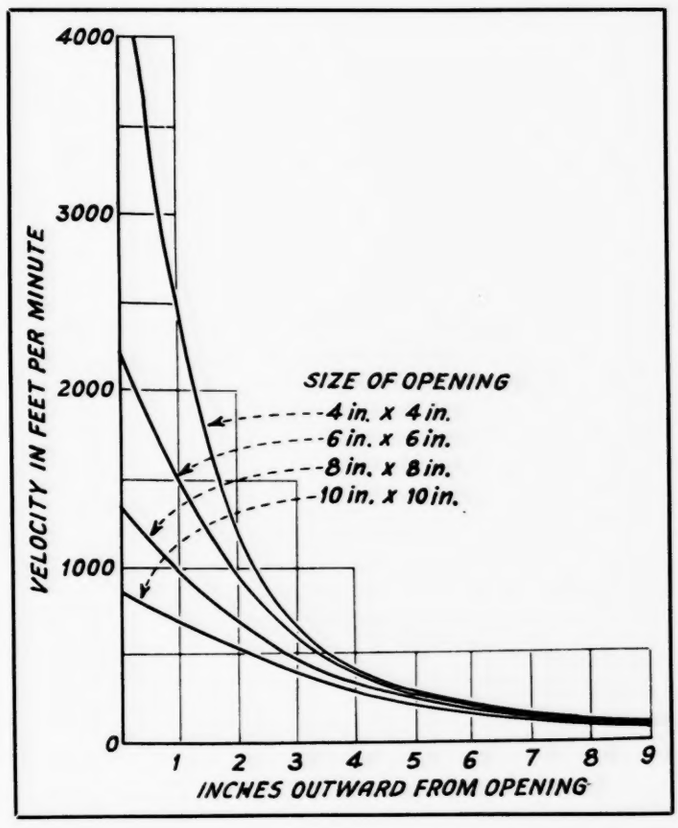


Fig. 3. (Above)
Fig. 4. (Right)

## Change of Velocity with Distance Outward Along Axis of Hood

Of particular interest to engineers is the manner in which the velocity decreases outward along the axis of a hood. This is shown for a set of square openings in Fig. 4. The air flow for each opening shown is kept constant at 500 cfm. It will be noted that the change in velocity is lessened as the size of the opening is increased. In the small openings, 4 in. x 4 in. and 6 in. x 6 in., the velocity at a distance of 2 in. outward along the axis is reduced



to less than one-half the average velocity at the opening itself. It is also to be noted that as the distance from the opening increases, the velocities become the same regardless of the size of the opening. This fact is implied in Equation (1) and will be discussed more fully later.

### Representation of Velocity Contours and Stream Lines

For a given opening, the general shape and distribution of velocity contours and stream lines are the same, regardless of the amount of fluid entering the opening. This fact is of far-reaching importance since it is possible to represent the nature of flow into a given opening by a single diagram.

Verification of the above principle is shown by the experimental data plotted in Fig. 5. Fig. 5a shows the relative position of two sets of contours, namely, when the average opening velocities are 500 feet and 1000 feet per minute. It may be seen that corresponding velocities are displaced. However, if these velocities are expressed in terms of the velocity at the opening (say on a percentage basis), the contours align themselves in an orderly sequence as indicated in Fig. 5b. The contours of Fig. 5b hold, regardless of the velocity at the opening.

It may seem that the plots given in Fig. 5 hold only for an opening of one size, and that separate representations are necessary for openings of different sizes, but this is not the case. All similar openings can be reduced to a given size merely by changing the units of measurement. A 4 in. x 8 in. opening is identical with an 8 in. x 16 in. opening, if we halve the size of the units of measurement. However, it is simpler merely to map the region of influence for both hoods in corresponding units. Thus, two circular openings, 4 in. and 10 in. in diameter, correspond if each is divided into the same number of units. Velocity contours and stream lines for two similar openings of different size will coincide if plotted on a grid fitted first to one and then to the other opening.

### Principle of Similarity of Velocity Contours

It is evident from the foregoing that geometrically similar openings have similar velocity contours and stream lines. This fact may be restated as follows: *The positions of the velocity contours for any hood when the contours are expressed in terms of the velocity at the hood opening are purely functions of the shape of the hood; the contours are identical for similar hood shapes when such hoods are reduced to the same base of comparison.*[2] For example, if the velocity 4 in. outward along the axis of an 8-in. diameter duct end under suction is 26% of the velocity at the plane of the opening, the same value must occur for a 12-in. diameter opening at a distance of 6 in.

That the above principle holds for rectangular hoods may appear confusing, since the velocity distributions vary in every axial plane throughout a whole quadrant. However, in corresponding planes of two openings the principle does hold.

Rectangular hoods are designated as similar if the ratio of their sides is the same. Therefore, two rectangular hoods will have similar velocity characteristics, provided the radial planes are mapped in corresponding units and if the velocities are expressed as percentages of the velocity at the opening.

*This principle of similarity offers a powerful tool for research, since large hoods may be tested in model form and their characteristics deduced. It is a basic principle applying to all hoods, reducing them to their simplest terms.*

*(Next month's installment will discuss velocity characteristics of unobstructed openings).*

[2]Dalla Valle, J. M., 1932. Velocity Characteristics of Hoods Under Suction. *Heating, Piping and Air Conditioning*, 4, 370-375.

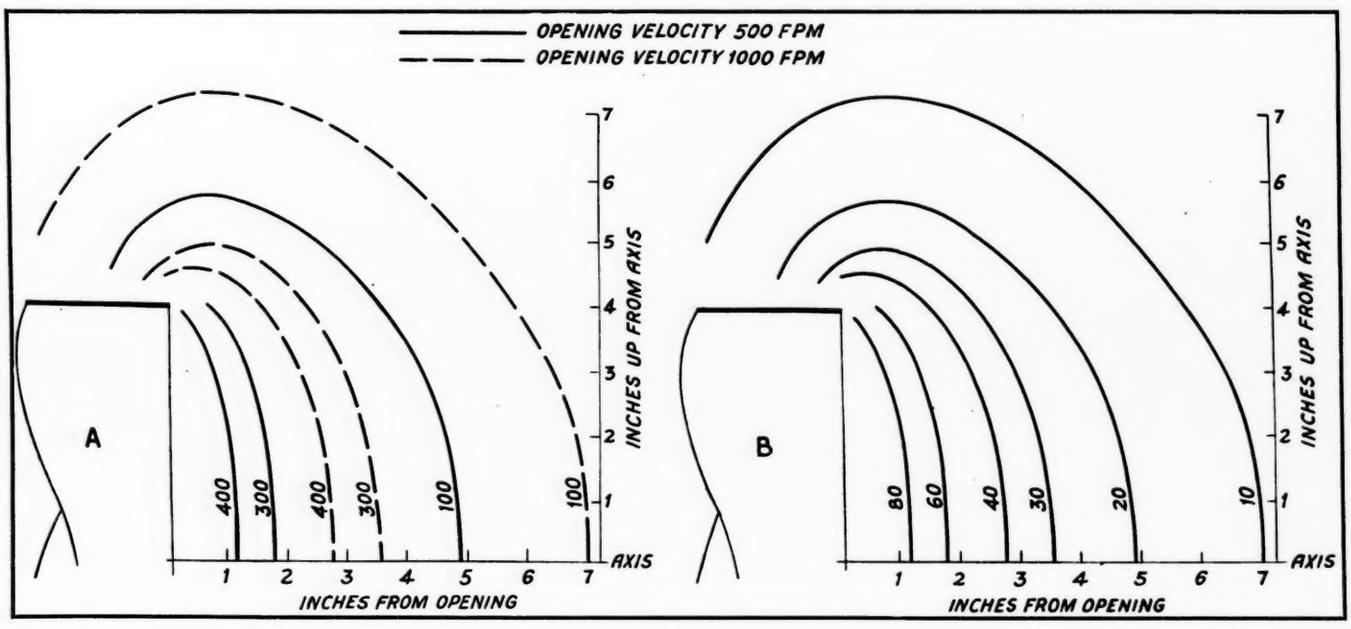



Fig. 5a.

Fig. 5b.

# WASHINGTON NEWS

## *Summarized by Loring F. Overman. Committee Urges Adequate A.C. Service; Heating & Plumbing Section Revamped; Utilities Office Issues Its First Order.*

The shortness of the month is all that kept February from producing, in Wasnington, a record number of both direct and indirect mandates influencing the affairs of those connected with heating and ventilating industries. Despite the fact that the short month included four Sundays and an unobserved holiday, Washington's bureaus found time to grind out the following:

(1) A War Manpower Commission program implemented by Presidential order, to distribute workers among essential industries by making a 48-hour week mandatory in specified industries and in 32 labor shortage areas;

(2) A spectacular WPB drive to eliminate production bottlenecks by means of production directives;

(3) An OPA food rationing plan that will be followed by developments affecting those who engineer and manufacture cold storage equipment;

(4) A further tightening, on the part of WPB, of building restrictions, and

(5) A scramble on the part of all WPB divisions, including those concerned with heating, ventilating, air conditioning, and refrigeration, to bring "M," "L" and "P" orders into synchronism with the Controlled Materials Plan of distributing steel, aluminum and copper by allocation instead of by means of preference ratings.

### A-C & R Reorganizes

To bring its setup into line with new requirements, Air Conditioning and Refrigeration became a section of a new Special Equipment Branch of the General Industrial Equipment Division of WPB. Frederick Smith, formerly with Frigidaire, is chief of the Special Equipment Branch, with Sterling Smith as chief of the A-C section and Roderick Tate as deputy.

The eight units in the section are as follows: Materials Allocation, Gordon Wooten, chief; Unitary Equipment, Bert Meyer, chief; Industrial Commercial Machinery, Howard Keeler, chief; Industrial Air Conditioning, M. C. Terry, chief; Emergency Service, Roderick Tate; Commercial Refrigerator Unit, Howard Foreman, chief; Accessories, Leo Freitas, chief; Staff Unit, Sterling Smith, supervisor, assisted by W. A. Smylie, F. B. Millham and W. B. D'Zorna.

Reuben Ottenheimer is consultant for the section, which has the following Industry Advisory Committees: general refrigeration and air conditioning, commercial refrigeration, water coolers, refrigerator valves and fittings, fin coils and coolers, industrial refrigeration, condensing units and refrigerator copper solder-type fittings.

In addition to the foregoing committees, which meet on call of WPB to discuss industry problems, three special task committees which have presented reports and have been discharged are the Essential Uses, Repair and Maintenance task committee and the "In Use" Equipment task committees.

As a result of recent conferences involving the A-C Section's advisory and task committees it has been recommended that the number of self-contained mechanical water coolers be reduced; air-conditioning servicing rules have been simplified; drafts of policies and procedures for transferring "in-use" equipment from non-essential to essential use are nearing completion, and two important "L" orders are soon to be revised.

### L-38 and L-126 Changes Due

It is expected that on or before March 10 an amendment will revise many of the provisions of Limitation Order L-38, applying to industrial and commercial refrigeration and air conditioning machinery and equipment and that L-126, applicable to related machinery, will be completely re-written.

The revision of L-38 is to contain changes in procedure affecting the re-distribution of equipment now in use, among essential war industries. Details of such transfers will be handled through the Air Conditioning Section, with the Used Equipment Branch of WPB's Re-distribution Division assisting.

In the latter division John Jex Jr., until recently in charge of air conditioning and refrigeration conversion, has been made chief of Special Programs, which includes not only air conditioning and refrigeration but programs involving typewriters, sewing machines and equipment released by programs previously administered by WPA, NYA and CCC.

S. S. Fretz III has taken over Mr. Jex's work in air conditioning and refrigeration conversion within the Redistribution Division. Important to the success of the program is the bill pending in Congress to make federally-owned equipment available for more essential uses. The bill, which has passed the House, was undergoing Senate conferences as February closed.

### A-C Upkeep Urged

Immediate action to safeguard essential refrigeration and air conditioning equipment against breakdown, and to provide for quick re-

*Four important consultants added to the Plumbing and Heating Division of the War Production Board during February are shown above. (Left to right) David Gulick, Eljer Co.; L. R. Taylor, International Heater Co.; L. N. Hunter, National Radiator Co.; G. E. Otis, Herman Nelson Corp.*

*Lionel E. Wieser, chief of the new Controlled Materials Plan unit and deputy chief of the Distribution Section of Plumbing and Heating Division, War Production Board.*

pair service was recommended in a task committee report presented at a joint meeting of the Advisory Committee of the General Refrigeration and Air Conditioning Industry and the Heavy Machinery Segment of the Industrial Refrigeration Industry held in mid-February in Washington.

The committee pointed out the importance of refrigerating and air conditioning equipment in food processing, transportation and storage, and in the production of many items directly needed for war, including chemicals, explosives, and synthetic rubber. War production, it was recognized, will be retarded and serious loss in food supplies will occur if this equipment breaks down and cannot be quickly repaired.

It is expected that the increased use of fresh food, due to restrictions on canned and processed foods for home consumption, will make greater demands on transportation and storage refrigeration.

The task committee, appointed to investigate repair and maintenance problems, based its conclusions largely on data secured from seven trade associations representing approximately 90% of the industry. The findings show that there are serious delays in delivering repair parts because of difficulty in obtaining critical materials; and that there is already a serious shortage of skilled labor. Among recommendations made by the committee are the following:

(1) Higher preference ratings should be granted for materials for emergency servicing of industrial and commercial refrigerating and air conditioning systems;

(2) A supply of raw materials should be made available immediately for repair and replacement parts to take care of emergency breakdowns; and

(3) A plan should be worked out to provide against possible widespread breakdown of refrigeration equipment in a given area. (Measures to be taken in such an emergency should include the granting of priorities on the use of refrigerated space and transportation and on service and repair labor.)

Members of the task committee are A. B. Schellenberg, Alco Valve Co., St. Louis, Mo.; F. S. McNeal, Universal Cooler Co., Marion, Ohio, and M. G. Munce, York Ice Machinery Corporation, York, Pa.

## P&H Division Revamped

The gradually tightening program of "Produce for War in '43" is occasioning numerous shifts in the activities and personnel of the Plumbing and Heating Division of WPB. The Division is slated to move soon from its Steuart building offices to larger quarters as yet unannounced. Expanded activities, it is explained, dictate the move.

Important among personnel changes is the addition of four consultants to the staff, as follows:

L. N. Hunter, vice-president, National Radiator Co., Johnstown, Pa., is consultant on cast iron boilers and radiators. He had worked with the Division for a few months early last year;

Gerald E. Otis, vice-president, Herman Nelson Corp., Moline, Ill., has been appointed consultant on extended surface heating equipment, which includes unit heaters, unit ventilators and similar products. He has been with the Herman Nelson Corporation for 25 years;

Leslie R. Taylor, vice-president, International Heater Co., Utica, N. Y., is now consultant on warm air furnaces. He has been with the International Heater Co. for 30 years;

David Gulick, vice president, director and sales manager of Eljer Co., Ford City, Pa., is consultant on plumbing fixtures and equipment. He has been with his company since 1921.

Among other staff changes, Ronald Allwork has resigned, because of ill health, the position as assistant to the Division Director, Joseph L. Wilber; Hillman M. Brown becomes acting chief of the Inquiries section, succeeding Joseph T. Kelly Jr., who will transfer to the WPB Power Division; Bernard J. Lasker has been transferred from the New York office of WPB, where he was in charge of PD-1A and PD-200 administration, to become chief of the Rating unit. Mr. Lasker succeeds P. J. Schaack, who will transfer to the Resources section as deputy chief to Morgan Johnson.

William F. Bilyou has succeeded Lewis Smith as chief of the Plumbing section and Lionel E. Wieser has been named chief of a new CMP unit.

*Hillman M. Brown, who has been made acting chief of Inquiries Section of the Plumbing and Heating Division, War Production Board.*

Early revision of all the Division's orders that conflict with the intent and mechanics of the Controlled Materials Plan is assured, executives of the Division report.

## L-187 Amended

Quotas of iron and steel that may be used in the manufacture of low-pressure cast iron boilers for war housing and civilian replacement needs, and in the repair parts for such boilers, during the first six months of 1943, were increased February 13 with the issuance of an amendment of Limitation Order L-187.

Because of abnormal seasonal requirements for repair parts, due in part to the reduced supply of new boilers and in part to conversions from oil and gas heating units to solid fuel burning types, the industry has been hampered in meeting the demand, both for parts and for completed boilers under the quota previously in effect.

Manufacturers producing solid fuel burning boilers for civilian replacements and repairs are authorized under the amended order to use iron and steel during the first six months of 1943 in an amount equal to 13% of the metal which they put into process in the fabrication of component parts of boilers during the calendar year 1940.

The amended order slightly increases the weight of iron and steel that may be assembled and shipped in the form of completed boilers. The number of completed boilers that may be shipped must not exceed 4½% of the weight of iron and steel "put into process in the manufacture, fabrication or assembly of component parts of low-pressure cast iron boilers during the calendar year 1940."

Completely assembled boilers which were in a manufacturer's inventory on January 1, 1943, or boilers assem-

bled since that time from parts in his inventory on that date, are not subject to the restrictions of the amended order. The amended order provides that any manufacturer who does not use his full quota during the first six months of the year may process his unused first-half allowance during the last six months of the year.

Likewise, any manufacturer who has not shipped his full allowance of boilers in the first six months of 1943 will be permitted to ship the remainder during the last half of the calendar year.

No restrictions are placed upon the use of iron and steel in the manufacture of parts designed for conversion of oil and gas low-pressure boilers to coal burning equipment, or of repair parts for military or hospital low-pressure cast iron boilers.

### Valves Transferred

Administration of Schedule II of Limitation Order L-42 has been transferred to the Valve and Fitting Section of the Shipbuilding Division of the War Production Board. The Limitation order, which conserves the use of various metals by standardizing plumbing and heating fixtures and stops, is administered by the Plumbing and Heating Division. Schedule II, administration of which has been transferred, relates to the simplification of gray cast iron, malleable iron, brass and bronze pipe fittings.

### Building Order L-41 Amended

The unenviable position of non-essential construction is further highlighted in a February 20 amendment of Conservation Order L-41, which is designed to limit construction in order to conserve materials, facilities and labor for essential war uses.

The amended order re-defines maintenance and repair of a building, specifically designating that where a single job is partly maintenance and repair and partly new construction, the whole project will be considered new construction and subject to L-41.

The amendment applies to private dwellings and commercial structures, and reduces to $200 new construction which may be undertaken, without specific authority by a number of manufacturing enterprises which are not essential to the war program. Under the new definition, maintenance and repair means the work that is necessary to keep a structure in sound condition, but it does not include any building operation involving an alteration or design change.

### Unit Issues First Order

The Office of War Utilities, recently created within the War Production Board to administer war activities of water, steam, electric, gas and communications utilities, issued its first basic order February 24.

The order U-1, replaces the formerly P-46 and all amendments and supplements thereto, re-enacting most of the P-46 provisions. It governs the flow of materials into the entire utilities field with the exception of communications and is the first industry order to be integrated with the Controlled Materials Plan.

An important group of provisions within the order, designed to effect sharing of materials and equipment in utility inventories, requires utilities to sell surplus stocks as a condition for continuing to receive priorities assistance. These provisions are linked with the creation of regional surplus stock offices, to be in operation throughout the United States in March, through which utilities will carry on the redistribution.

The order, for the first time, brings under inventory regulation stocks of controlled material held by utilities for use in construction and limits such holdings to 60 days.

## FEBRUARY WASHINGTON NEWS HIGHLIGHTS

Editor's Note:—Supplementing its regular summary of Washington news, HEATING AND VENTILATING publishes the following monthly index to press releases and other government-issued material of particular interest to those affiliated with heating, ventilating and air conditioning industries. Copies of releases or publications listed may be secured by writing U. S. Information Center, 1400 Pennsylvania Avenue, Washington, D. C. Dates of February releases, together with reference numbers which should be included in requesting copies, follow:

23rd — CUT IN WATER COOLERS URGED. 1943 requirements for self-contained mechanical drinking water coolers can be substantially reduced, a task committee has reported to WPB Water Cooler Industry Advisory Committee. WPB-2362.

22nd — 50,000 HOUSING UNITS STARTED. 50,000 government-financed housing units for war workers were placed under construction during January, Federal Public Housing Commissioner Emmerich announced today. OWI-1314.

22nd — VALVES STANDARDIZED. Control valves, liquid level controllers, and pyrometers and resistance thermometers are simplified by GLO L-272, issued today by WPB. WPB-2268.

21st—RESTRICTIONS SAVE CRITICAL MATERIALS. An annual saving of two million tons of critical metals, and untold tonnage of other essential materials, is being made through restrictions and curtailments of products of hundreds of civilian household articles, the Consumers Durable Goods Division of WPB reported today. WPB-2588.

20th—BUILDING REPAIRS DEFINED. A revised definition of what constitutes maintenance and repair of a building is contained in amendment to C.O. L-41, effective February 19. WPB-2603.

19th — GET COAL BEFORE CONVERTING FURNACE. Because wartime demands have made certain coals difficult to obtain, those planning to convert heating plants to coal should make arrangements to secure coal supply before starting conversion, it is advised by Solid Fuels Coordinator Ickes. OWI-1294.

18th—CONSTRUCTION PROJECTS STOPPED. Construction projects of non-war nature having total cost of $1,301,230,566 have been stopped during the last 16 weeks to free materials and equipment for war use. WPB announced today. WPB-2584.

18th—WAR CONSTRUCTION DOUBLES 1941. War construction activity in 1942, with total value of $12,145,059,000, more than doubled 1941 volume and amounted to more than 97% of the program for the year, WPB announced. WPB-2591.

17th—FANS AND BLOWERS CONTROLLED. Control of production of fans and blowers was placed under new limitation today by Director General for Operations of WPB, in Order L-280. WPB-2567.

15th — PROTECTION OF REFRIGERATION URGED. Immediate action to safeguard essential refrigerating and air conditioning equipment and to provide for quick repair service has been recommended in a task committee report to WPB. WPB-2548.

13th—IRON, STEEL FOR BOILERS INCREASED. Quotas of iron and steel used in manufacture of low-pressure cast iron boilers for war housing and civilian replacement, for first six months of 1943, were increased today by amendment of Order L-187.

12th — WPB-NHA HOUSING POLICY REVISED. The joint declaration of policy of WPB and NHA regarding war housing, which became effective February 10, was further implemented today with revision of Preference Rating Order P-55.

11th — WAR HOUSING RULES CLARIFIED. Regulations clarifying and simplifying requirements controlling occupancy and marketing of privately-owned war housing were announced today by NHA Administrator Blandford.

10th — WAR HOUSING AUTHORIZATION SOUGHT. NHA is requesting $4000,000,000 increase in war housing mortgage insurance authorization to assure adequate financing arrangements for a large proportion of 130,000 dwelling units still to be financed out of total current quarter for private war housing construction. OWI-1238.

10th—WAR HOUSING POLICY IMPLEMENTED. Joint WPB-NHA policy on war housing was implemented today by revision of housing application forms for priority assistance. WPB-2499.

8th — AIR-CONDITIONING SERVICE RULES SIMPLIFIED. Under the terms of Order P-126 as amended today, a dealer engaged in emergency repair service for refrigerating and air-conditioning systems may apply preference ratings assigned by the order if he holds certificate of authority. WPB-2462.

5th — BUILDING PROCEDURE SIMPLIFIED. Operators of office or loft buildings, apartment houses, hotels and industrial plants need file only a single application for blanket authorization to cover small miscellaneous construction work for a period up to six months, WPB announced today. WPB 2456.

5th—VALVE SECTION RULES ON PIPE FITTINGS. Administration of Schedule II of Limitation Order L-42 has been transferred to Valve and Fitting Section. Schedule II relates to simplification of gray cast iron, malleable iron, brass and bronze pipe fittings. WPB-245-9.

5th—SPECIAL GRATES GET SPECIFIC CEILINGS. Special combination grates recently developed by manufacturers for installation in heating boilers being converted from use of oil to coal were placed under dollars and cents ceiling today by OPA. OPA-1614.

**Setting a trap for germs. This scene inside the air conditioning duct of a large chemical plant shows a workman installing Sterilamps. Ultraviolet light from the lamps will kill 95% of the bacteria in the air passing through the duct, thus purifying the air the workers breathe and lessening the possibility of contaminating products.**

# Safety Requirements for Sterilamps in Air Conditioning Systems

By A. R. DENNINGTON

Special Products Sales Department, Westinghouse Electric and Manufacturing Company, Bloomfield, N. J.

**An earlier article discussed from a performance standpoint the use of ultraviolet radiation for the sterilization of air in air conditioning systems. The present article deals with installation details and problems, especially those involving questions of safety, wherein a knowledge of and compliance with existing regulations is required.**

AIR circulating systems in theaters, stores, apartments, offices and homes provide the vehicle for supplying these spaces with adequate air supply properly warmed and humidified or cooled and dried for the comfort of the occupants of the rooms.

Operating economy precludes the use of all fresh outside air during the seasons when this fresh air is appreciably cooler and dryer or warmer and more moist than the comfort conditions desired inside the building. It is therefore necessary in most climates where air conditioning is installed, to recirculate 50% to 75% of the air in the system and to use fresh air to dilute and revitalize the working air supply.

The recirculated air carries a larger population of living organisms than the fresh air and thus may be a means of distributing throughout the system bacteria or viruses from any one afflicted with a cold or other infectious disease. Therefore, in addition to the removal of dust particles from the air, it is desirable to reduce the bacteria to a level at least equal to or lower than the contamination level of fresh air available.

Recently, two methods of sanitizing the air supply have been studied, (a) the irradiation of the air by means of bactericidal ultraviolet, and (b) the use of sprays which have a bactericidal action. This article is concerned only with (a), and primarily with just that phase of (a) dealing with the practical problems of safeguarding and wiring the ultraviolet lamps when installed in the ducts of an air conditioning system. The lamps referred to are ultraviolet gener-

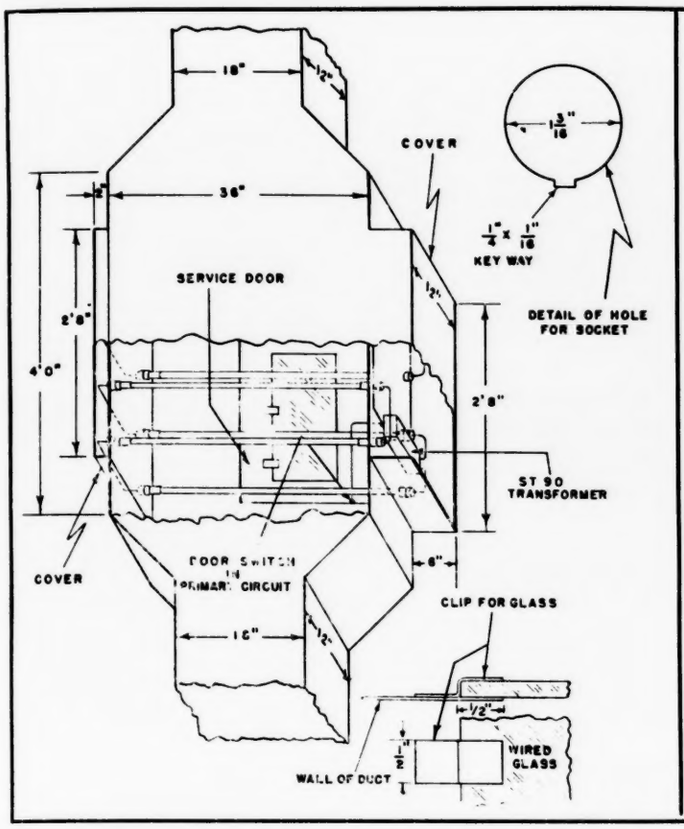



Fig. 1. Typical duct installation in an air conditioning system. The duct is enlarged to fit the lamps, also to decrease air velocity past the lamps and thus increase exposure time.

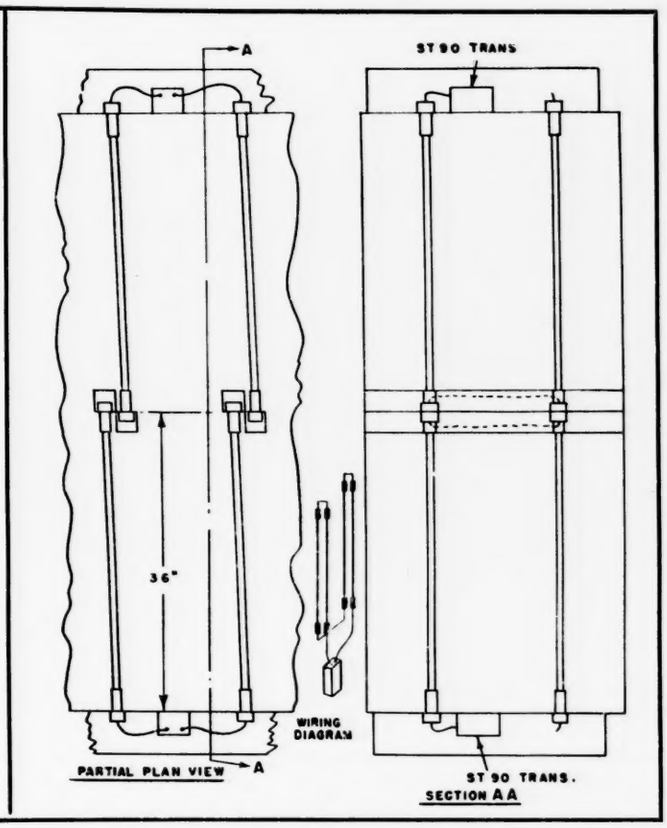



Fig. 2. Lamps for air conditioning systems are made in recommended lengths of 30 in. with a distance of 36 in. between receptacle supports. Ducts accordingly are sized to widths of 36 in. or multiples thereof.

ators, patented and known commercially as Sterilamps.

## Fire and Smoke Hazards

From the standpoint of the Fire Underwriters air ducts must be constructed, equipped and maintained in such a manner that there is no chance of damage due to fire and smoke originating within the duct. When, for purposes of internal illumination ordinary electric lights are mounted in air ducts, this requirement has made necessary the installation of vaporproof globes over the bulbs since lamps of this type have heated filaments. Such lamps operate at temperatures which may cause ignition of dust collecting on the bulb, or in case of breakage of the bulb particles of hot filament may start a fire in oil soaked filters or accumulations of dust.

Since ordinary glass enclosures around ultraviolet lamps would absorb much of the radiant energy and prevent the irradiation of the air passing through the duct, thus defeating the purpose for which the lamps are installed, it was necessary, in applying the Underwriters' regulations, to consider temperature characteristics. Sterilamps are made with cold electrodes which are not heated either to start the discharge or to maintain it during operation. Tests made on 30 in. lamps mounted horizontally in still air and spaced 2¾ in. apart indicated a maximum temperature of 214F at the warmest point directly over an electrode and the average temperature at this point for 10 lamps was 156F. The average temperature over the active discharge portion of the lamps was 122F with an ambient air temperature of 70F. These temperatures are not high enough to be considered a fire hazard.

## Wiring

In order to meet these conditions paragraph 181 of the Standards of the National Board of Fire Underwriters for the Installation of Air Conditioning, Warm Air Heating, Air Cooling and Ventilating Systems was modified to read as follows:

"Electrical wiring and equipment shall be installed in accordance with the National Electrical Code. Lamps within the enclosure of the conditioning system shall be enclosed in fixtures of the marine (vaportight) type, except that germicidal lamps of a type not using filament, and which operate at relatively low exposed surface temperatures, need not be so enclosed."

The only material which can be classed as combustible and which may be placed within the air duct in the typical lamp installation is the insulation on the wires used for connecting the receptacles or sockets supporting the lamps. Normally the current regulating transformers required are placed outside the duct and only the high tension wires leading to the receptacles are within the enclosure. Where insulated wires are used it is essential that they be Type GTO-5 gas tube sign cable and be run in enclosed raceways as a protection against possible abrasion and to guard against the possibility of smoke being

carried into the air duct and distributed throughout the building, if the insulation should become ignited.

Connecting the receptacles with No. 10 A.W.G. bare copper wire eliminates combustible insulation within the air duct and reduces installation costs, as enclosed raceways are not used. The essential insulation is obtained by maintaining a spacing of at least one inch between the wire and any grounded metals. Non-combustible, non-absorptive insulators such as have been used in neon signs are spaced at intervals of not more than 18 in. and not more than 6 in. from a terminal other than that of an electrode terminal. Ordinarily, electrode terminals designated Bryant LD-75 are spaced 6 to 15 in., hence intermediate insulators are not required.

### Safety and Service Features

A typical arrangement of Sterilamps in an air duct is shown in Fig. 1. The duct has been enlarged to accommodate the lamps and to decrease the velocity of the air over them. The distance between receptacle supports is 36 in. for a 30 in. lamp, the size which for economic reasons is recommended for use in air ducts. It is therefore convenient to make one dimension of the radiation chamber 36 in. for ducts of moderate size and multiples of 36 in. for large installations. Holes for the electrode receptacles are 1 3/16 in. in diameter and are provided with a keyway to prevent the receptacle from turning. Lamps are inserted or removed from the receptacles by loosening the metal ferrule on one receptacle and sliding it back about 2 in. to allow clearance for the lamp over the edge of the receptacle. When the lamp is in place the receptacle is pulled forward and the ferrule is tightened in place.

### Windows

It is important to be able to see the groups of lamps to determine if they are all in operation, hence, windows made of wired glass are provided. As ordinary commercial glass or wired glass will not transmit the ultraviolet radiation, no bactericidal rays escape through the chamber windows. Wired glass is required for mechanical strength and resistance to shattering to prevent the spread of fire if flames are drawn into the duct. Underwriters' regulations specify that no individual window shall exceed 720 sq. in. in area. The glass is supported by metal troughs or clips of not less than 24 U.S.G. ½ in. or more in width, overlapping the glass ½ in. and spaced not more than 6 in. along each edge of the glass nor closer than 1½ in. from a corner. Windows must be fitted substantially air tight to prevent leakage of air from the duct. However, if gaskets are used, they must be of felt or synthetic material not affected by ozone which is generated in small amounts in the radiation chamber. The ozone which is developed is very largely broken up during the passage of the air through the duct and the metal outlet grills so that it is not detectable in the areas served by the system.

### Doors

Service doors of sufficient size and number are required to permit reaching and replacing any lamp in the group. As the intensity of ultraviolet radiation is high and since bare conductors may be used in the

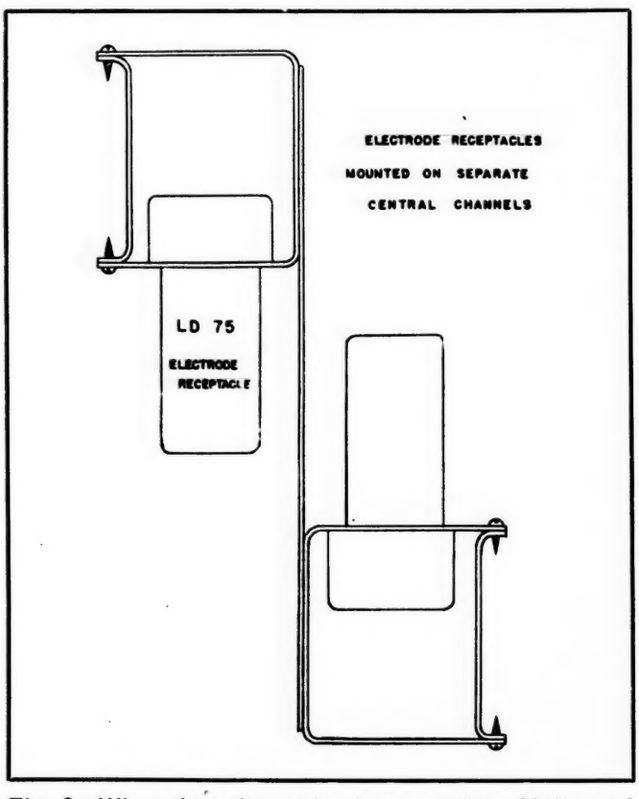



**Fig. 3. When duct dimension is more than 36 in. and somewhat less than an even multiple, lamps extending in from opposite sides are overlapped and bracketed together to insure stable cross connections.**

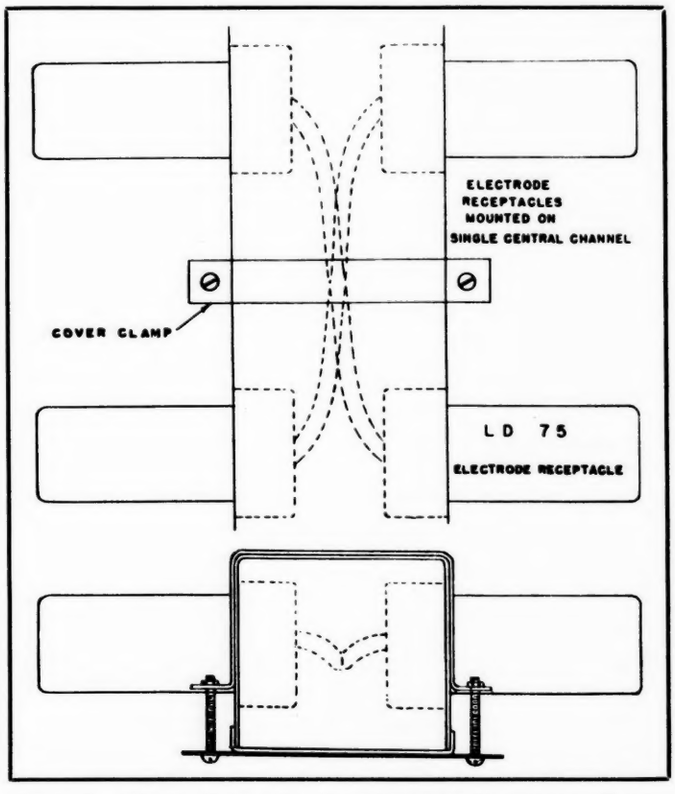



**Fig. 4. When duct size is somewhat in excess of an even multiple of 36 in., the lamps are bracketed together with a gap between the inner ends, and connections made as shown.**

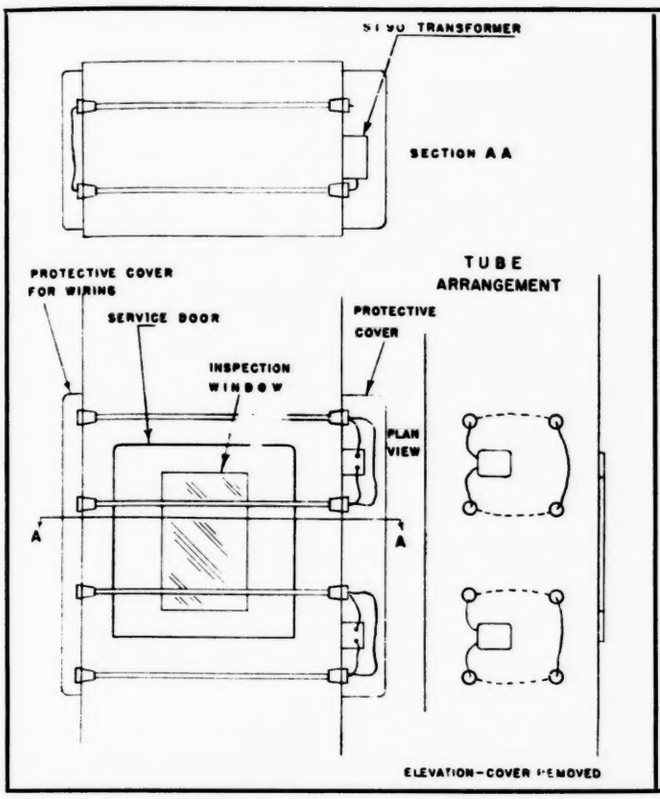



**Fig. 5. Plan and sectional view showing arrangement of lamps, transformers, and series wiring between lamps and transformers.**

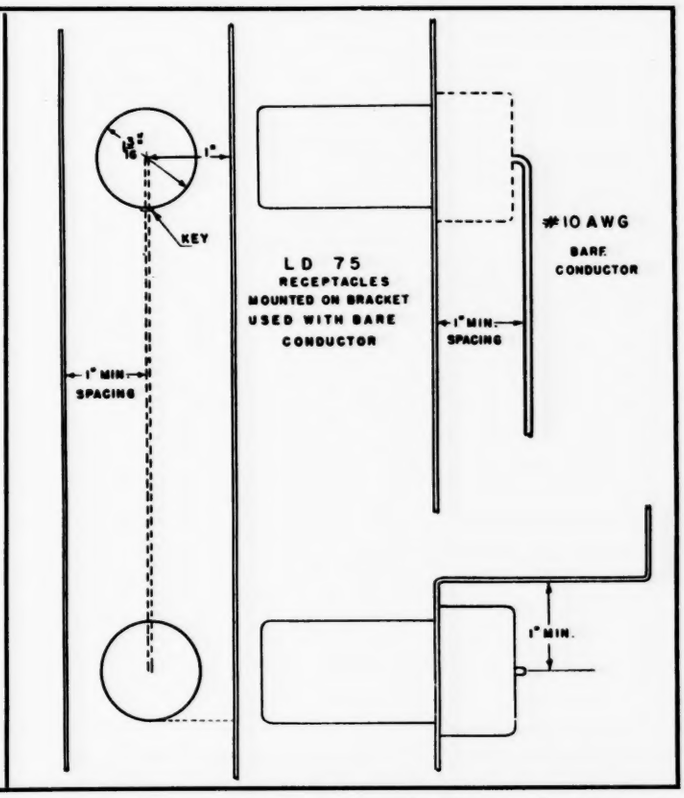



**Fig. 6. Bare copper wire, spaced at least 1 in. from any grounded metal, should be used for all receptacles inside the ductwork.**

radiation chamber, it is necessary to provide interlocking switches on the service doors to open the primary circuit supplying the transformers when any service door is opened. The switches for this purpose must be of a type listed by the Underwriters and have a current capacity at least twice that of the current rating of the circuit controlled. These safety features prevent any person entering the radiation chamber from being exposed to the high intensity radiation or to possible contact with a 3,000 volt wire. For testing purposes the circuits may be arranged so that a group of four or eight lamps operated from one or two transformers may be put into operation by authorized persons and checked for ultraviolet output.

## Circuits

Primary circuits shall be so arranged that no group of transformers on any one circuit shall require in excess of 15 amperes. As the primary current on a 115 volt circuit required by an ST-90 transformer operating four 30 in. lamps is not more than 1.5 amperes, the maximum number of such transformers on a single circuit is 10. It is desirable to keep the number of transformers per circuit eight or less to permit greater flexibility in operating and testing.

## Lamp Mountings

Fig. 2 shows a wiring diagram for a duct installation of a group of 4 lamps connected in series to the secondary of an ST-90 transformer where the duct width is 6 ft. If the width or height of the duct or radiation chamber varies somewhat from multiples of three feet, the electrode receptacles at the center of the chamber may be allowed to overlap as shown in Fig. 3 when the duct dimension is less than the required even multiple, or to be spaced apart as shown in Fig. 4, when the duct is oversize. It is possible, in this way, to adapt the spacing of the inner electrode receptacles to fit the lamps, which are of fixed length, but which must be installed in air ducts of different widths. Where air ducts are only a few inches less than 3 ft, the lamps may pass through holes in the wall of the duct and the electrode receptacles may be supported on brackets outside the duct. If so, a tight cover must be provided over the receptacles to prevent leakage, as the openings in the side walls must be large enough to permit insertion and removal of the lamps. Where the walls are spaced several inches more than the standard 36 in. the bracket supports may be fastened inside the duct. Some reconstruction or modification of the duct for the radiation chamber is usually necessary, hence, the specifications of the Underwriters Laboratories are made to permit these changes without interfering with the essential safety features.

Transformers may be enclosed singly or in groups in metal enclosures of material not less than No. 24 U.S.G. in thickness and may be mounted on top or sides of the air duct as shown in Figs. 1, 2 and 5. The supports for electrode receptacles connected with bare wire may consist of simple L shaped brackets, Fig. 6, made to give the minimum spacing of 1 in. between the wire and any grounded metal.

# HOW TO MEET WAR TIME RESTRICTIONS

## BY T. W. REYNOLDS

**EDITOR'S NOTE: During this war the designing engineer must execute a right about face and give priority to the conservation of critical materials rather than to such factors as cost, efficiency, appearance, comfort and convenience. As time is also the essence of the war contract, it may require a fine balance of judgment as to whether time or material is paramount at the moment, not forgetting that the sole purpose of conserving critical materials is, in the final analysis, the saving of lives. If cost involves a disproportionate amount of man-hours, it, too, must be given serious consideration, as labor may also be termed critical. In the interest of this effort the information which follows has been prepared as an indication of the tremendous savings which can be made in the use of critical materials as applied to heating, ventilating and air conditioning projects. It supplements and, in some cases, enlarges upon similar material presented as Reference Section No. 9 in last month's issue of HEATING AND VENTILATING.**

### Second-Hand Materials

Not everyone has the correct viewpoint as to the use of second-hand equipment. For example, assume a project in which it is proposed to install a steam heating system with a 5 ton boiler and 5 tons of metal required for the balance of the system. Suppose that the metal necessary for a complete warm air system would be only 5 tons. In such a case it is clear that the warm air system should be substituted for the proposed steam plant. However, the engineer may have located a suitable second-hand boiler, so that from one viewpoint either system will need the same amount of metal. What should he do? The answer is that he should use the system requiring the least total weight of critical material. The reason for this is that the second-hand boiler might serve to good advantage in some other project where a boiler is necessary, such as in an existing steam plant where the boiler is worn out or must be increased in size due to plant expansion. Aside from this, there still remains the thought that at least in principle all second-hand equipment is at the disposal of the government and should be contributed to the war effort. Probably before the war ends not only will second-hand equipment be placed on inventory, but equipment not utilized 100% on the job it is doing, may be so listed also.

Considerable used and second-hand equipment is being continuously picked up on the market, much remains, and more always seems to be on hand when wanted. Railroads have accumulated equipment for years which has been removed from their discontinued plants as changes come about. Equipment in industrial plants is constantly being abandoned or removed to make way for plant expansion and plants under way are suddenly stopped upon governmental order, leaving the material on hand available for other projects.

It may be interesting to note that even a steel company manufacturing structural steel and pipe should make use of second-hand pipe for installation in any of their plant extensions for the same reasons that they now, because of the war, use wood instead of structural steel for the erection of any new buildings of their own. Obviously, the materials from which structural steel and metal pipe are made are all critical and therefore subject to priority whether or not they are for the use of the steel manufacturer or some other manufacturer; furthermore, second-hand pipe has more than scrap value as it is immediately available for war production and conserves on labor and equipment which would otherwise be required for the new pipe it replaces.

### Fuel and Power

Increased gas requirements for war production and civilian uses and the scarcity of materials for the construction of pipe lines and other gas facilities have produced a shortage of gas in certain areas and a threatened stoppage in other areas, especially during periods of adverse weather conditions when the demand in many areas will increase beyond the capacity of existing facilities to meet demand. Limitations are therefore necessary upon deliveries of gas and the integration of gas system operations needed to maintain gas deliveries.

Gas-fired unit heaters or other gas-fired equipment and any materials for use of such equipment are generally not allowed for space heating or steam generating equipment except where it replaces similar gas equipment of equal or greater capacity as operated by the same consumer for the same building. In any event special permission for the use of gas is required. Gas-fired equipment for natural gas for non-domestic consumers may be allowed where the aggregate usage is not over 5000 cu ft in any one day (24 hours), or in any less period of time, but such equipment for the use of manufactured gas must have an aggregate input capacity of less than 150 cu ft per hr. Natural gas means natural gas or mixtures of this gas with manufactured gas. Natural gas varies in heat value from 700 to 1500 Btu and is usually 1000 Btu per cu ft, whereas manufactured gas varies from 520 to 545 and is usually 535 Btu per cu ft.

Any consumer who considers that gas deliveries are necessary for war production or the operation of an essential civilian service may apply for exemption from the restrictions, submitting proof that compliance therewith would work an exceptional and unreasonable hardship upon him or that he cannot reasonably use any fuel other than gas, natural or mixed natural and manufactured, because of technical utilization factors or process requirements. In one case, gas for space heating was denied even though its use would have greatly conserved metal, for only a small amount of metal would have been required in gas pipe and a number of gas unit heaters. Furthermore, the quantity of gas required was only 5% of that required for process within the plant. On the other hand, it would have used much more metal to extend the gas pipes or increase plant capacity of that utility so as to provide the additional gas which, it was felt, should be available for process elsewhere.

There are a very few applications where a limited amount of electrical energy for heat can be used more advantageously with less critical materials than with any other form of heating, especially where the heating load can be added without increasing the plant power demand, and also where large amounts of power are available and where there is a lack of hard fuels which, if brought in, would require transportation.

Electric heating may use much less of critical materials (1) where condensate cannot be returned, (2) where buildings of small size are in a remote location and long distribution lines would give high heat losses and use a disproportionate amount of critical materials, (3) where temporary heat is required and the electric equipment can be re-used elsewhere, (4) for night or week end op-

# S IN HEATING AND AIR CONDITIONING DESIGN

eration where operation of large steam plants would waste fuel and man power, and (5) where the use of other fuels would create too great a fire or explosion hazard as in laboratories, chemical processes or vaults for the storage of ammunition.

Equipment utilizing butane, propane and liquefied petroleum gas for space heating, water heating, and cooking is not allowed.

Installation of equipment and facilities using fuel oil (Grades 1 to 6 and Bunker C, kerosene, range oil, gas oils, and any other liquid petroleum product) use for the same purpose as the foregoing designate grades) is permitted only in certain states and is allowed in all other states only upon special permission.

Because of such restrictions, and more particularly of the ever increasing risk of plant shut-down due to lack of oil, conversions from oil fuel are rapidly increasing in number. The change-over is usually to new coal burning equipment, or to connection with a street steam utility burning coal. In the latter case conversions sometimes require more of critical materials than would be obtained with new coal burning equipment, especially where the building boiler is remote from the street; nevertheless, such conversions save in coal handling, man-hours and in the amount of fuel used. The amount of critical materials required in such cases in ratio to the saving in fuel oil usually increases as the fuel oil saving decreases, because the meters and other utility equipment required do not vary directly in weight or quantity as the load varies.

In one case conversion from oil was made to waste heat from kilns by means of a heat exchanger and a non-metallic warm air duct system which was substituted for the existing steam heating systems, even though this was done at a substantial increase in the amount of critical materials over that required for conversion to coal. Obviously this was the thing to be done, because neither oil or coal fuels or their transportation were required. Maintenance of steam piping, traps, and furnace linings was also no longer required and in addition to this a large amount of scrap metal and second-hand equipment was released for re-use elsewhere.

In some cases it is practically impossible to convert from oil to other fuels and in such cases the fear of plant shut-down, due to lack of oil, should not result in the installation of an undue amount of oil storage equipment, such as fuel oil tanks which serve but to hoard oil and which, even when obtainable second-hand, serve only as a diversion of metal to a less essential purpose.

## Non-Metallic Equipment

Certain heating and ventilating equipments as listed in the following, in addition to other items of non-metallic construction mentioned in the previous article, should be of non-metallic materials. All have the advantages of metal conservation, ease of handling, less weight required in the structure itself, and they offer some relief for the transportation system. The following are examples:

Throats above fireplace dampers.

Pulleys, belt guards and other safety guards such as at fan inlets.

Screens at gravity low temperature exhaust outlets, if in quantity. Screens are obtainable of plastic materials, but because of their slow burning qualities and reinforcement required due to flexing under air pressure, may be unsuited to air intakes or to inlets and outlets of large size. Iron screens where necessarily used should be of black iron painted. The discharge of corrosive gases will, of course, require metal which will withstand corrosive action.

Ducts, except that 15% of the weight of an all-metal system of ducts is allowable for sheet metal connectors and hangers, also any additional weight within reason as required for turns in exhaust systems conveying abrasive materials. In some cases where the location of the installation is remote and where the metal required would be small in amount, all-metal systems should be used to avoid undue hardship due to lack of non-metallic materials or unfamiliarity with their application.

Grilles, louvers, duct turns and dampers, except those motor operated. Non-metallic grilles are made of wood, or of cane set in wood frames. Metallic grilles are allowable in dwellings and hospitals and where non-metallic grilles are not available. Registers are metallic, though one manufacturer is now making them of wood.

Ventilators, gravity stationery type and enclosures for powered type. However, a make of power ventilator is available with metal enclosure, but so designed with straight unrestricted blow-through that motors may be of smaller size than normally used, with resultant saving in copper.

Rope-drive sheaves. At least one manufacturer makes rope-drive sheaves of maple. Sheaves of this material offer certain advantages.

Air filters, except those of the mechanical type.

Casings at fan chambers and pent houses. These can be built of brick, tile, concrete, hard asbestos, or other non-metallic materials.

Equipment foundations and their supports wherever possible. Note that large timbers and soft wood are critical. Second-hand lumber can be used.

Radiator or convector cabinets and enclosures, including fronts.

Stair treads, platforms, railings and ladders. A fixed or portable wood ladder should be sufficient in war time for access to main valves and other important equipment.

Gratings over trenches, hoppers, etc. These are available in wood that will withstand the usual wear and tear. Wood gratings have the advantage of lightness when removed for access.

Manhole covers and frames, except that reinforcing rods, ferrous-metal cover rings and protection may be used. According to the Cast Stone Institute, 32 lb of metal is necessary for the construction of a 24 in. reinforced concrete manhole frame and cover.

Boiler jackets in all cases except where the boiler cannot be conveniently furnished without a jacket or where the boiler is furnished from stock and already has a metallic jacket.

## Copper, Rubber, Zinc

Zinc coating is not allowed on piping for oil (including vent and fill pipe, compressed air, process water or other process except where the nature of the process requires it); on heating, sprinkler and fire protection, nor on hot water expansion tanks (or any other tanks except for domestic hot water supply and water storage); pipe hangers, breechings and smoke pipes or other sheet metal construction; and insect screens at outdoor intakes and fan discharges. Where screens are essential, the size of wire should be reduced, the size of mesh increased in so far as practicable and the frames should be non-metallic. Zinc coating or lead is allowed on piping in refrigerator boxes, wherever condensation may form on exposed piping and on fins and coils of unit heaters. Zinc coating is permitted on hot and cold water pipes for building service.

Restrictions on elimination of copper or brass are so well known that only the less known restrictions will be mentioned herein. These include fire-hose couplings and fittings; name, identification and metal plates; non-operating or decorative parts of installation; mechanical equipment (including frames, base standards and supports); paint, pipe and fittings, plating primarily for decorative purposes, valve handles, water containers for humidification, weather-stripping, and valve bodies 2 in. in diameter and over. Some valves are now made in iron down to and including the ¾ in. size.

Reclaimed rubber is allowed for hose. Rope drives are also permitted of rubber, as the total weight of a rope drive is not excessive and of this weight only about one third is rubber, of which half is reclaimed, and the balance is cotton cords. Rope drives are often essential to process machinery due to limitation on space conditions for such machinery.

## Non-Critical Pipe

Many substitutes for iron pipe have been proposed and some of these have been found satisfactory mainly for sewer and water pipe usage. Pipes made of concrete or of cement asbestos are not easily obtainable; plywood pipe is obtainable even in small sizes but prices are prohibitive. Glass pipe is made only in small quantities, and suitable joints are a stumbling block for large sizes of mains. Many companies are manufacturing wood stave pipe, which is quite satisfactory; and extra-strength clay pipe, tested for 75 lb pressure, is also a suitable substitute for certain uses.

Concrete pressure pipe requires more steel reinforcing than wood pipe designed for the same pressure; the reinforcing amounts to approximately 10% of the weight of the pipe for lower pressure and up to 50% for higher pressures. The weight of concrete pipe militates against shipping it over 100 miles. The facts seem to be at present that it is not practical to specify reinforced concrete pressure pipe smaller than 6 in. or 8 in.

Spiral riveted pipe is difficult to obtain quickly as manufacturers require high rated priorities to get skelp from the steel mills. However, this pipe has possibilities for projects designed well in advance of building construction and, in addition, a certain amount of it is available second-hand. Light-weight pipe of this kind has its uses such as in exhaust steam heating. Such pipe may be obtained in black iron with or without asphalt coating. The pipe lengths may be welded or joined with light cast-iron flanges and with medium pressure cast-iron gate valves and fittings. Light-weight pipe has other advantages such as lower first cost, less transportation cost and ease of erection.

A good example of saving in weight of pipe was noted on one project where the change was not from low pressure to high pressure steam as suggested in the previous article, but rather the reverse, from high pressure to low pressure. It was proposed to install a 20-inch exhaust line from drop hammers in one building to the heating system in another building 300 ft distant. The pipe to be used was ¼ in. thick and made of critical steel plate, and at the beginning of the run a 3 in. high pressure steam line at 175 lb pressure was connected for make-up live steam. The pipe line between buildings would weigh 16 tons; in an endeavor to cut down on this weight it was proposed to extend the 3 in. high pressure line make-up to the other building where it could then be connected to the heating main at the end of the run. This involved the use of two mains, but reduced the necessary size of the proposed 20 in. main to 16 in. with a weight for the two mains of only 10 tons. It was then decided to substitute spiral riveted pipe for the 16 inch main, so that the tonnage of the two mains was again reduced, this time to only 4 tons, and in this way 12 tons of steel were saved.

The production of asbestos cement pipe calls for some African fibres and such fibres are obviously critical; however, they were normally imported because either in the process or in the quality imparted in the finished product they provide properties lacking in Canadian fibres. For example, certain grades of African fibres, because of their extremely low iron content, are more acid resisting than Canadian fibres.

Canadian grades of asbestos are classified into No. 1 and No. 2 Crude, and Fibre groups Nos. 3 through 7. The only critical fibres are the No. 1 and No. 2 Crudes and the No. 3 Spinning which are the so-called long fibres. The reason they are critical is that their supply is limited compared to the demand for asbestos textiles for war requirements.

Low pressure pipe insulation uses a non-critical Canadian fibre. Magnesia insulation has been restricted to a certain extent in order to make certain that the capacity of the industry would be reserved for necessary defense uses as other types of insulation can be used in most cases for temperatures under 212F.

## Heat Exchangers

Coils of steel must be used in indirect water heaters, tankless water heaters, and other hot water heaters and generators except where they are for use in hospitals, bakeries, and laundries, in which case coils may be of copper; circulating pipes between heater and tank should be of ferrous metal. Zinc coating is allowed. Copper tubes are also allowed for condenser tubes and heat exchanger tube sheets in oil refining plants and in plants generating steam or electric power.

Tankless water heaters make larger boilers necessary, but save a steel tank and connecting pipes. Separate coal-fired water heaters, where used in the summer months, should be used all year round so as to eliminate installation of indirect water heaters and their connections. Circulating pumps and return circulating lines for domestic hot water supply are, in general, out for the duration. Feed water heaters of cast iron compared to those of steel plate of same capacity weigh from 30 to 60% more for pressures below 30 lb and about 30% more for pressures from 30 to 60 lb. Feed water heaters of steel plate are 5/16 in. thick for pressures 30 lb and below and 5/16 to 7/16 in. thick in the larger sizes for pressures from 30 lb to 60 lb.

## Tanks

Closed pressure tanks may be built of steel sheets or plates, but such tanks for pneumatic water systems are not allowed if in excess of 82 gallons storage capacity. Generally, plates for other tanks will not be allowed. Plates should be reduced to sheets under 3/16 in. thick wherever possible and less than 72 in. wide. Tanks should be obtained second-hand wherever possible. Elevated storage tanks intended principally for fire protection should not be used unless suitable fire fighting equipment is not available locally and it is considered that the loss of the facilities so protected would most seriously hamper the war effort, in which case the thickness of the shells should be less than 3/16 in. For towers supporting tanks, structural steel may be allowed if towers are more than 50 ft high. Chemical agitator tanks for water treatment and other steel water tanks carry the same requirements as for elevated steel storage tanks.

Reinforcing steel should be used only in a limited amount for concrete tanks and ferrous metal accessories for wood tanks. Fuel oil storage tanks, if built of ferrous metal, should have shells less than 3/16 in. thick. Underground oil tanks of reinforced concrete require one fourth the steel required for all tanks of equivalent capacity. Complete engineering specifications as to construction of such tanks may be had by addressing Structural Bureau, Portland Cement Association, 33 West Grand Ave., Chicago. This Association re-

ports satisfactory results from concrete tanks which have been in service from eight to twenty-two years. Blow-off tanks, septic tanks and receiving tanks or sumps for sewage should also be built of reinforced concrete. Old boiler drums are sometimes used for blow-off tanks. Fuel oil tanks should not be sized for hoarding oil but for a limited supply, especially so where oil is easily obtainable.

## Steel Versus Cast Iron Convectors

Rolled steel products and cast iron are not on a weight parity, but are related from a critical standpoint (steel being the more critical) in a ratio of from one to two or one to four, so that the weight of metal in a cast-iron convector may be considered comparable with the weight of metal in a steel convector. In this connection, it is interesting to note that limiting the manufacture of radiators to the slim-tube type created a demand for this type to such an extent that it later had to be relieved by encouraging the increased use of light-weight extended surface. At present the manufacturers of cast iron radiators are not operating at maximum capacity and there is also an excess capacity of cupolas available for this purpose, whereas steel convectors require the use of open hearth furnaces and steel scrap for their manufacture, both of which are critical to a certain extent.

In the manufacture of cast-iron heating surface the small amount of waste is fed back into the cupola, whereas in the manufacture of steel heating surface there are certain elements of waste such as occur in trimming to size, stamping of holes, pouring of the furnace to the finished billet and in rolling the billet down to sheet. This waste requires transportation back to the steel mills and a melting loss in the furnace of about 10% which is not recoverable, although the metal itself is recovered. Both steel and cast iron heating surfaces require the use of pig iron and scrap, but cast iron requires only pig iron scrap whereas steel requires about 35% of steel scrap, 15% of iron ore and the balance of pig iron. Furthermore, open hearth furnaces are frequently fired by oil, another material of strategic importance, but cupolas for cast iron require only coke in all cases and coke is a by-product.

## Ash Handling

Pneumatic ash conveying systems require a dustless unloader (usually with a 5 hp gear motor) when the ash is from pulverized coal and when stokers of the spreader type are used, since such stokers produce a dusty ash. However, a spreader stoker is available with a light unloader using a motor of only ½ hp. Steam jet exhausters are now commonly employed, for motor-driven exhausters are weighty affairs with motors of from 50 to 100 hp.

Small air washers are required in extreme cases when the ash is very dusty and where this condition is accompanied by a small storage tank and the plant is one whose process cannot be contaminated, such as the production of milk cultures or where the plant is located in a crowded portion of a city. Venting the ash storage tank to the chimney is of some help in eliminating any nuisance in the immediate locality. Some ash disposal systems are of a type which sluice the ashes over a large area for filling land, or to a sluice trench, or to a sump settling pit.

## Direct Fired Heaters

In making any comparisons of warm air heating with steam heating, one should include in the weight of critical materials for the steam heating system under comparison the weight of any metal required for ventilation, boiler house, boiler breeching, possible coal and ash handling machinery and water softeners and lightning rod, foundation reinforcement and other metal items of the chimney. If the steam plant is of large enough size it will require steel boilers and these are made of critical steel plate, a disadvantage which will in itself make necessary the choice of a warm air system. Even the use of a second-hand boiler in such a case would not affect this reasoning, as explained under previous comments on second-hand equipment, nor would the use of high pressure boilers in order to reduce pipe sizes, as such boilers would involve still more of critical plate as well as pumps and other auxiliaries.

Where ventilation with outdoor air would normally not be allowed it may in some of the more urgent cases be allowed with direct-fired warm air heaters in milder weather up to the point where no increase in size of furnace, fans or motors is required beyond the heat loss requirements of the structure; and further providing the fuel required is not critical in kind and excessive in amount.

Saving in fuel and its transportation are essential to the war effort, so it is in order to comment that steam heating systems have heat losses from boiler settings, breechings, and distribution piping which are not utilized in the spaces to be heated; furthermore, steam boilers are not sufficient in number or size to operate at highest efficiencies under partial loads as with direct-fired warm air systems. Steam heating systems also require more of critical materials for maintenance of piping, boiler tubes, and the like.

Direct-fired warm air systems will not require less of critical materials as compared to steam heating systems where there is sufficient boiler capacity already on the premises, providing, of course, that the extension of piping from boiler plant to heater spaces is not too long.

## Pipe Coils

The weight of pipe coils in pounds per square foot of radiation as placed horizontally is 3.2, 3.5 and 3.8, respectively, for 1 in., 1¼ in., and 1½ in. pipes. As coils so placed are usually at the ceiling, where generally they are not so effective, the weights required will increase 25% to 4.0, 4.4 and 4.7 lbs, respectively.

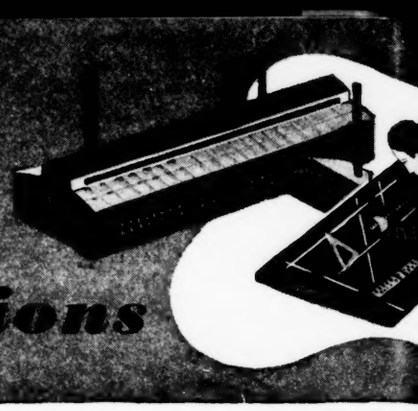
## Wood

So much wood is now used in or for the support of heating and ventilating equipment that it bears mention. Douglas fir, Oregon pine and softwood lumber are critical, as is lumber in sizes 10 in. and over. Form lumber should be re-used or second-hand lumber should be obtained. Designs should not be based on long lengths or excessive quantities of any one length and specifications should call for standard grades only, and the lowest possible grade as a minimum which could be used for the purpose. Normal safety factors may be exceeded in some cases. Where large girders or posts are required, alternates should be provided for glued laminated sections built up of 1 in. and 2 in. material.

The large quantities of green wood now being used in construction and the moist character of certain building sites combine to create conditions favorable to termite infestation and decay in many areas. In the absence of eaves and gutters this condition is aggravated, hence adequate ventilation and soil drainage should be provided. Inspections have disclosed many places where supporting posts, incidental lumber such as form work or wood stakes left in place, or even the wood construction of the structure itself facilitated termites infestation by forming a bridge from the ground to the timber structure proper.

Buildings without basements should have the space below the floor ventilated by openings with a total area of ½ sq ft for each 25 lineal feet of outside wall plus an allowance of ½ sq ft for each 100 sq ft of building area. This gives a reasonable safety factor for any shape or size of building, but the size of ventilating openings may be varied from this rule for dry and wet situations and where cross ventilation cannot be obtained. Where the structure is an infested area, termite shields should be provided, using impregnated felt instead of metal.

# REVIEWS of TECHNICAL publications



## AIR CONDITIONING ANALYSIS

**"Air Conditioning Analysis with Psychrometric Charts and Tables", by William Goodman. Published by The Macmillan Company. Price $6.00—455 pages.**

*This review prepared by M. C. Giannini, Asst. Prof. Mechanical Engineering Dept., New York University.*

Mr. William Goodman, who for years has been contributing many articles to the technical press on the general subject matter of graphical solution of psychrometric problems, has written an excellent book completely covering the subject of air conditioning analysis. The book is unique in that, as the title implies, it deals in the science of changing the condition of air and does not treat air conditioning equipment or design. Hence no material is included on the physiological aspects of air conditioning, heat transfer, cooling and humidifying load computations, air distribution, duct design, fan performance, heat transfer equipment selection, control equipment and other material usually included in texts on air conditioning.

Beginning with chapters on "Fundamentals," Mr. Goodman develops the thermodynamics of psychrometry, based on sound analytical methods but interpreted through the use of psychrometric charts. The basic charts are of the Molliere type which plot temperature against enthalpy. True enthalpy is used, not the sigma function recommended by Carrier and Mackey. However, the values of enthalpy of dry air based on the usual datum of 0F have been arbitrarily increased by 10. While this may cause some minor confusion to a reader in comparing values with those obtained from other sources or texts, the reason for this procedure is sound in that it avoids negative values of enthalpy for air mixtures at low temperatures.

Throughout, the author has used the simple and lucid style for which he is well known. The derivations of all formulae are grouped in an appendix at the end of each individual chapter. While this may be confusing to some readers, those who are interested in results alone and not in the mathematical development will find this feature most convenient. By the use of the steady flow energy equation all of the thermodynamic processes of vapor-air mixtures normally encountered in air conditioning practice, are developed and clearly illustrated by means of the graphical analysis. Even problems dealing with conditions to the left of the saturation curve on the psychrometric chart are solved in a chapter entitled "Fogged Air."

A feature of this text is more than 150 pages of psychrometric tables covering not only the standard barometric pressure of 29.92 in. of mercury but also all values of barometric pressure from 22 in. to 32 in. of mercury by 1 in. increments. While this would not have any practical value to the average designing engineer, it will be of great assistance to those who encounter unusual problems as well as to the laboratory technician or test engineer who must check actual observations seldom at standard barometric pressures. Of more than ordinary interest is the final chapter dealing with the geometry of the construction of the psychrometric chart.

On the whole, the text cannot be recommended for the beginning student, but for the practicing engineer as well as the advanced student this unique text with its tables and charts should prove a most valuable addition to his reference library.

## PLYWOOD COEFFICIENTS

**"Revised Commercial Standard CS45-42" and "Section 5". Additions to "Technical Data on Plywood," published by Douglas Fir Plywood Association, Tacoma, Wash.**

These two new sections are available to holders of the loose-leaf handbook "Technical Data on Plywood." The first of these, Section 1a, is a revised commercial standard which became effective November 16, 1942. This section contains changes in grade descriptions and panel dimensions.

Section 5, consisting of 8 pages, gives basic information on the insulating properties of plywood. A feature of this section is the complete set of tables giving heat transfer coefficients for various thicknesses and combinations of plywood as used in building walls, ceilings and roofs.

## CONDENSING UNIT STANDARD

**"Commercial Electric Refrigeration Condensing Units—Commercial Standard CS(E) 107-43." Published by U. S. Dept. of Commerce, National Bureau of Standards, Washington, D. C.**

Following its circulation in October 1942 to the commercial refrigeration trade, and containing subsequent revisions based on suggestions resulting therefrom, adoption of this new standard is announced, effective May 15, 1943.

Subjects covered include requirements, rating, motor loading, and testing of air-cooled and water-cooled belt-driven commercial units in 1/5 to 3 hp sizes, also water-cooled units of 5 hp using methyl chloride, freon 12, or $SO_2$ refrigerants. All applications including air conditioning are considered, as are minimum requirements for controls, shut-off valves and receiver tank capacities.

## DUCT CAPACITIES

**"Simplified Procedure for Selecting Capacities of Duct Systems for Gravity Warm-Air Heating Plants," by A. P. Kratz and S. Konzo. Published by the University of Illinois, Engineering Experiment Station, Urbana, Ill.**

Certain limitations have become apparent in the gravity warm air heating Code which was adopted in 1922 and which was based on certain fundamental figures derived in extensive tests at the University. It is recognized that the fault lies neither in the fundamental data upon which the original Code was based nor in the method in which the Code was presented; yet it is felt that any modification which tends to simplify the procedure of designing a gravity warm air furnace system and, insofar as possible its installation, will be an improvement. Consequently, this new circular No. 45 is intended to present a method which may be considered as an extension of, or a practical application of, the principles underlying the standard Code without suggesting that the Code itself be discarded.

Paper-covered, 6 x 9 in., 48 pages. Available without charge until July 1, 1943 or as long as the supply lasts, upon request to the Engineering Experiment Station, Urbana, Ill.

## FUEL SAVING

**"Saving Fuel in Oregon Homes," by E. C. Willey. Circular Series, No. 7. Published by the Engineering Experiment Station, Oregon State College, Corvallis, Ore.**

Written by the same author who has recently done outstanding work on sawdust burners and the use of sawdust as a home-heating fuel, this 36 page, 6 x 9 in. booklet, should prove a helpful and practical guide in fuel conservation. The author intends it primarily as an aid to those whose actual experience in heating is limited but who must economize and get the most out of their fuel under present conditions. The following chapter headings will indicate the field covered:

Where Heat Goes and How to Reduce Losses; Technical Insulation Data; Heating Systems; Factors Affecting Furnace Efficiency; Technical Combustion Data; Correcting Faulty Combustion; Technical Data on Fuels and Burners; A report of Wood Fuel Investigation; Care and Adjustment of Wood Burning Equipment; and Automatic Temperature Control.

## EXHAUST VENTILATION

**(1) "Centerline Velocity Characteristics of Round Openings Under Suction," and (2) "Velocity Characteristics of Narrow Exhaust Slots," by L. Silverman. Reprinted from the Journal of Industrial Hygiene and Toxicology, November, 1942.**

An extension of work done on this same subject several years ago by Dalla Valle and Hatch is described in these articles by the investigator, who is a member of the Industrial Hygiene Department, Harvard School of Public Health in Boston. The earlier studies had been limited by lack of sensitivity in the air measuring instruments so that no data on velocities less than approximately 120 fpm could be taken. But in these recent investigations, the use of heated thermometer anemometers made it possible to explore regions of much lower velocities, some readings being as low as 23 fpm.

In the study of round openings a complete series of unflanged openings from 2 to 20 inches in diameter were investigated to determine centerline velocity equations. The new values thus derived differ from earlier results mainly because of the greater range of distances explored and sizes covered. An accurate non-dimensional type of equation, as well as modified practical equations for both flanged and unflanged hoods, have been worked out by the author. The limitations of these equations are also explained.

The paper on narrow slots presents results of tests covering several sizes of unflanged slots. The only existing equation on this subject is based on extrapolated data from rectangular openings. No fundamental study on sizes and centerline characteristics of simple slots has been published. Results indicated that for unobstructed plain or flanged slots the velocity varies inversely with distance from the slot and with slot length and that slot width is of no importance if the slot is flanged. The value of flanging decreases with decreasing slot width.

Size of reprints: 7 x 10 in., (1) 8 pages, (2) 10 pages.

## WATER HEATER STANDARD

**"Recommended Commercial Standard (Emergency) for Testing and Rating Hand-Fired Hot Water Supply Boilers, TS-3406." U. S. Department of Commerce, National Bureau of Standards, Washington, D. C.**

This new standard, which covers boilers designed to supply hot water to service water tanks with ratings up to 450 gallons per hr at 100F rise, is being circulated to producers, distributors and users for their written acceptance. The standard was adopted at the General Conference held in Washington, D. C., December 4, 1942. The proceedings of the conference are given in detail in a supplementary standard, TS-3405.

## FURNACE GUIDE

**"Anthracite Telephone Service". Published by the Anthracite Industries, Inc., Chrysler Building, New York.**

In an effort to help anthracite dealers in maintaining good service to customers, a questions and answers book has been prepared by which a large percentage of service complaints and calls received are expected to be satisfactorily settled without sending the serviceman out on call. The book is well illustrated, logically prepared, and conveniently indexed for quick reference, and should well serve the purpose for which it is designed.

Size, 9 x 12 in., 18 pages and paper covered.

# NEWS OF THE MONTH

## Mineral Wool Council Formed

CLEVELAND—Confronted with an unprecedented demand for insulation, manufacturers of mineral wool have established a Mineral Wool Industry War Council to develop maximum wartime efficiency in the production of insulation.

Established at a meeting in Cleveland late in January, the Council set up a committee to find means for increasing production. Other committees were appointed to cooperate with the Government in studying problems relating to the manpower shortage, elimination of cross hauling, allocation of raw materials and possible concentration of production.

A general executive committee was elected to act on behalf of the Council, consisting of E. I. Williams, Riverton Lime & Stone Co., Riverton, Va., chairman; T. C. Carter, Eagle-Picher Sales Co., Cincinnati, secretary; H. F. Beyer, Ludowici-Celadon Co., Chicago; L. M. Cassidy, Johns-Manville Sales Corp., New York; A. M. Douglass, National Gypsum Co., Buffalo; G. E. Gregory, Owens-Corning Fiberglas Corp., Toledo; M. L. Kuykendall, Insulation Industries, Inc., Detroit; C. L. Neumeister, American Rock Wool Corp., Chicago; C. L. Newport, Coast Insulating Corp., Los Angeles; and M. M. Stone, M. H. Detrick Co., Chicago.

## Fuel Clinic Promotes Conversions

BOSTON—A fuel conservation show was opened at 72 Brookline Avenue Feb. 4, as a free public service and clinic to encourage and help householders convert from oil to coal. It consists of displays of heaters, grates, conversion jobs, financing information and a personalized consulting service. Plans are under way to continue the show through the summer and next fall in expectance of greater numbers of conversions for the next heating season.

## ASHVE Discusses Air Recovery

LOS ANGELES—Air recovery systems as developed for war needs in heating, ventilating and air conditioning systems was the subject of a talk delivered at the February 10 meeting of Southern California Chapter, American Society of Heating and Ventilating Engineers, by Joseph S. Earhart, Los Angeles, engineer.

## Cork Insulation Now Permitted

LANCASTER, PA. — The Armstrong Cork Company announced February 22 that it has been advised by the War Production Board that all restrictions on the use of corkboard insulation have been removed.

Sloane C. Martin, manager of the industrial insulation department of Armstrong's Building Materials Division, stated that WPB Order No. M-8A, as amended February 20, now permits cork to be used for roof insulation, for the insulation of air conditioning equipment, and all other non-war purposes previously banned under the mandatory priority control placed in effect by the WPB in June 1941.

Mr. Martin said that the new order does not end the allocation system but that monthly allocations of cork appear to be adequate for all military and civilian needs for corkboard insulation and for cork covering to be used on cold lines.

The Armstrong official stated that the present WPB action was made possible because of the unusually large stockpile of cork in reserve and because of increased shipments arriving regularly in this country from the Mediterranean area.

## Job Freezing Hits Heating Men

LOS ANGELES — Approximately 2500 workers in all phases of the heating industry in Los Angeles County, California, are affected by the job stabilization program put into effect in February after some three months of planning by labor representatives, employers and government officials.

Labeled job stabilization, the program is actually job freezing. Under the plan, workers in the heating industry may change jobs only if they have a certificate of availability and jobs will be given only when an availability certificate is produced. Such certificates will be issued only to workers seeking new jobs when a change in employment is regarded as being in the best interests of the war effort. Employers will not lay off or discharge workers except for circumstances beyond their control.

Of the total of 2500 heating industry workers affected by the plan, approximately 2,000 are estimated to be engaged in the warm air field in Los Angeles County in the form of installers, repairers and contractors. About 500 are engaged in boiler plant activities. Workers in refrigeration, air conditioning and ventilation are not affected by the new ruling.

## ASME Chapter Hears Dr. Carrier

CHARLESTON, W. Va.—How scientific knowledge in America has been advanced, due largely to the public demand for new and improved products, was explained recently by Dr. Willis H. Carrier, Chairman of the board of Carrier Corporation, in a paper presented before the West Virginia Section of the ASME.

The need for power driven pumps for coal mines brought forth the Newcomen engine, Dr. Carrier pointed out, adding that the ready-made demand for a new source of power enabled Watt to successfully develop his steam engine, without which the machine age would have been long delayed. Engineering improvements in large refrigeration machines for blackout plants, synthetic rubber processing and other large scale war projects, also the interdependence of air conditioning and refrigeration during the period of great expansion which both have undergone, were cited by Dr. Carrier as illustrating the important part one industry can play in the development of another.

He reminded his audience that although air conditioning is usually associated with comfort, today industries such as aircraft, munitions, chemicals and plastics are using air conditioning to increase war production.

## Coal Shortage in Europe

WASHINGTON — Europe is worrying about its coal supply; England is to be short of fuel but the real deprivation is to be experienced in the Hitler-occupied countries, according to *Coal Consumers' Digest*.

Poland reportedly must struggle along with virtually no coal. France with her supplies drained by Hitler, will be worse off than last winter. Civilian deliveries in Germany will be curtailed severely.

Contributing to the worries in the occupied countries is the condition of the channels of distribution. For this reason, Holland and Belgium are believed to be in better shape than France. Denmark, as last year, will burn peat while Norway will use wood.

## McBride Did Wright Job

The name of the heating and ventilating contractor given in the Wright Aeronautical Corporation article in our January issue as "McBride, Passaic, N. J." should have been listed as The Frank A. McBride Company, Paterson, N. J.

## Ontario Group Hears Tasker

TORONTO, ONT.—Fifty-five members and guests were present at the February meeting of the Ontario Chapter ASHVE held recently in the Royal York Hotel. One of the features of the meeting was the report given by Delegate C. Tasker of the annual convention of the society held in Cincinnati. An amendment to the constitution was unanimously adopted making it legal for the national chapter to invest funds, not only in United States Government securities and securities legal in the State of New York, but also securities of the Government of the Dominion of Canada.

Representatives of Crane Ltd., presented an illustrated address on "Flow", which provoked much discussion.

Hugh Jenny was elected chairman of the nominating committee, and Robert Bayles, J. Clifton, and H. G. Murray, members.

## HPAC Contractors Elect Officers

LOS ANGELES — J. Herman, Jr., of the J. Herman Co., Los Angeles, was elected president of the Heating, Piping and Air Conditioning Contractors Association of Southern California at the annual election meeting held here recently at the Hotel Rosslyn.

Other officers elected were Ray Younger, vice-president; John M. Moriarity, secretary; and H. C. Cary, treasurer. New directors include the officers and Louis Breer, Claude Hickman, Frank Schilling, Fred Reed and Loy Johnson.

## Stoker Research Continued in Pa.

HARRISBURG, PA.—Postwar production of a new domestic stoker which will successfully burn Pennsylvania bituminous coal for the heating of homes and for year-round supply of hot water was forecast in a report submitted Feb. 24 to the Pennsylvania Legislature on the "splendid progress" of research during the past two years at the Pennsylvania State College School of Mineral Industries.

The new stoker has solved the problem of coking and the fly-ash nuisance, according to the report, which declared that plans are being completed to get this stoker in production immediately following the war.

Work is continuing on development of a domestic service water heater for use with warm air furnaces, it was further revealed.

## L.A. Refrigeration Code Studied

LOS ANGELES—The Heating, Ventilation and Refrigeration Division of the Los Angeles Building and Safety Department has completed preparation of an amendment to the municipal code providing for regulation of refrigeration contractors and installers. The proposed refrigeration code, due for hearing before the board of building and safety on March 15, will require installers of refrigeration systems to take a qualifying examination and be subject to a license fee before a certificate to operate is issued. Contractors and journeymen will be subject to the regulation, but operating engineers will not be.

A revised heating and ventilating code is also scheduled for final hearing at the same time.

## Survey Reveals Compressor Data

NEW YORK—A nationwide survey of 1,506 refrigeration and air conditioning compressor installations by the York Ice Machinery Corporation in 1,000 civilian establishments reveals that more than 90% of this equipment is available for re-use by the armed forces and war industries.

The survey was undertaken to assist the government in locating and converting non-essential in-use refrigeration machinery to war needs. All compressor installations listed are of the Freon type and have been installed since 1932. Fifty per cent of the equipment, the survey reports, is less than five years old and individual plant capacities range from 40 to 2,000 tons including both reciprocating and centrifugal compressors.

## Canada Requires New Oil Record

OTTAWA, ONT.—Users of fuel oil in Canada, including householders, have been ordered to complete and return a form showing the amount of oil consumed in the heating system. The order issued by Oil Controller G. R. Cottrelle of Toronto, will enable the government to determine the amount of oil used and permit his office to prepare quickly and efficiently, should further restrictions prove necessary. The new order prohibits the supplying of oil for heating a private dwelling unless the consumer has filed his statement in accordance with provisions of the regulation.

The order also provides that except by oil control permit, no consumer of burning oil for home heating may switch from his present supplier, and no supplier may fill the order of a new customer for such oil. The special form will be distributed to oil suppliers.

## Study Post-War Heating

CHICAGO—Post-war trends in heating equipment and installation were discussed at a round table conference sponsored by the Advisory Research Committee of The Institute of Boiler and Radiator Manufacturers at the Palmer House here February 17.

The meeting was attended by manufacturers of boilers and radiators, and representatives of manufacturers of steam heating equipment, hot water heating specialties, controls, stokers, oil burners, heating contractors, research groups in the anthracite and bituminous coal interests, Plumbing and Heating Industries Bureau, and the University of Illinois.

The discussion at the meeting covered the entire field of probable post-war developments in steam and hot water heating both as to equipment and installation. The effect of trends in housing, shifts in population, prefabrication, insulation, and fuels on heating requirements was reviewed by 45 participants in the conference.

Speakers agreed that the present fuel crisis has had the effect of directing public attention to the advantages of the efficient and fuel-conserving type of heating plant with the result that purchasers of heating equipment in the future will be more efficiency-minded and less cost-minded.

Members of the Research Advisory Committee of The Institute of Boiler and Radiator Manufacturers which sponsored the conference are: John P. Magos, Crane Co.; L. N. Hunter, The National Radiator Company; J. F. McIntire, United States Radiator Corporation; H. F. Randolph, International Heater Company; and S. K. Smith, The H. B. Smith Company, Inc.

## Stanton Hertz

PITTSBURGH—Stanton Hertz, 48, vice-president and assistant to the president of the Copperweld Steel Company, Glassport, Pa., lost his life in a fire in his home here recently. A 13-year old daughter, Alice, also perished, while his wife and another daughter, Lois, were critically injured.

## Edward L. Dilworth

KITCHENER, ONT. — Edward L. Dilworth, 41, manager of the Canadian Blowers and Forge Co., died recently in the Kitchener-Waterloo Hospital. He was a graduate of Queen's University, Kingston. Surviving are his wife and one daughter.

# DEGREE-DAYS FOR JANUARY, 1943

HEATING AND VENTILATING'S 15th year of publication of monthly degree-day data

| City | Monthly Degree-Days | | | Cumulative Degree-Days | | | Year[1] |
|---|---|---|---|---|---|---|---|
| | Degree-Days, Jan., 1943 | Degree-Days, Jan., 1942 | Degree-Days, Jan., Normal | Season, 9/1/42-1/31/43 | Season, 9/1/41-1/31/42 | Season, Normal 9/1-1/31 | Normal, 9/1-6/30 |
| Abilene, Texas | 623 | 684 | 326 | 1523 | 1564 | 1251 | 2061 |
| Albany, New York | 1463 | 1332 | 1287 | 4167 | 3675 | 3726 | 6580 |
| Albuquerque, New Mexico | 819 | 862 | 924 | 2316 | 2605 | 2751 | 4298 |
| Alpena, Michigan | 1469 | 1354 | 1431 | 4427 | 3881 | 4382 | 8299* |
| Anaconda, Montana | 1444 | 1381 | 1321 | 4508 | 4752 | 4492 | 8357** |
| Asheville, North Carolina | 730 | 857 | 831 | 2386 | 2236 | 2520 | 4232 |
| Atlanta, Georgia | 586 | 706 | 682 | 1709 | 1654 | 1813 | 2890 |
| Atlantic City, New Jersey | 948 | 974 | 992 | 2565 | 2330 | 2727 | 5176 |
| Augusta, Georgia | 486 | 549 | 555 | 1318 | 1282 | 1441 | 2161 |
| Baker, Oregon | 1345 | 1281 | 1218 | 3990 | 4071 | 4033 | 7163 |
| Baltimore, Maryland | 932 | 905 | 955 | 2543 | 2138 | 2619 | 4533 |
| Billings, Montana | 1593 | 1218 | 1318 | 4251 | 4040 | 4134 | 7119 |
| Binghamton, New York | 1307 | 1248 | 1268 | 3831 | 3347 | 3783 | 6808 |
| Birmingham, Alabama | 552 | 689 | 589 | 1494 | 1540 | 1502 | 2352 |
| Bismarck, North Dakota | 2074 | 1414 | 1807 | 5658 | 4550 | 5321 | 9192 |
| Block Island, Rhode Island | 1105 | 1070 | 1048 | 3084 | 2737 | 2784 | 5788 |
| Boise, Idaho | 1141 | 1373 | 1097 | 3386 | 3648 | 3382 | 5552 |
| Boston, Massachusetts | 1226 | 1132 | 1150 | 3395 | 2954 | 3280 | 6045 |
| Bozeman, Montana | 1537 | 1547 | 1403 | 4589 | 4934 | 4689 | 8521** |
| Buffalo, New York | 1357 | 1264 | 1240 | 3850 | 3325 | 3612 | 6822 |
| Burlington, Vermont | 1604 | 1466 | 1429 | 4602 | 4213 | 4202 | 7514 |
| Butte, Montana | 1580 | 1579 | 1309 | 4949 | 5260 | 4492 | 8272 |
| Cairo, Illinois | 860 | 957 | 908 | 2341 | 2257 | 2407 | 3909 |
| Canton, New York | 1739 | 1529 | 1520 | 4781 | 4355 | 4514 | 8020 |
| Charles City, Iowa | 1652 | 1457 | 1560 | 4754 | 3888 | 4455 | 7588 |
| Charleston, South Carolina | 454 | 476 | 487 | 1092 | 984 | 1119 | 1769 |
| Charlotte, North Carolina | 648 | 704 | 725 | 1864 | 1679 | 1945 | 3120 |
| Chattanooga, Tennessee | 657 | 852 | 732 | 2004 | 2086 | 1957 | 3118 |
| Cheyenne, Wyoming | 1153 | 1257 | 1215 | 3929 | 4087 | 4104 | 7466 |
| Chicago, Illinois | 1312 | 1222 | 1274 | 3904 | 3081 | 3193 | 5957 |
| Cincinnati, Ohio | 951 | 1043 | 1017 | 2935 | 2592 | 2813 | 4684 |
| Cleveland, Ohio | 1153 | 1135 | 1181 | 3353 | 2919 | 3366 | 6155 |
| Columbia, Missouri | 1105 | 1053 | 1110 | 3062 | 2647 | 3006 | 4922 |
| Columbia, South Carolina | 524 | 578 | 586 | 1434 | 1328 | 1502 | 2364 |
| Columbus, Ohio | 1026 | 1103 | 1113 | 3121 | 2770 | 3133 | 5398 |
| Concord, New Hampshire | 1515 | 1388 | 1349 | 4375 | 4011 | 4081 | 7353 |
| Concordia, Kansas | 1209 | 1125 | 1184 | 3398 | 3003 | 3203 | 5315 |
| Dallas, Texas | 616 | 690 | 617 | 1479 | 1548 | 1487 | 2256 |
| Davenport, Iowa | 1382 | 1268 | 1352 | 3923 | 3186 | 3685 | 6289 |
| Dayton, Ohio | 1027 | 1094 | 1116 | 3126 | 2784 | 3063 | 5264 |
| Denver, Colorado | 938 | 1087 | 1079 | 3038 | 3266 | 3355 | 5874 |
| Des Moines, Iowa | 1428 | 1285 | 1392 | 3991 | 3328 | 3762 | 6384 |
| Detroit, Michigan | 1342 | 1213 | 1252 | 3835 | 3176 | 3584 | 6490 |
| Devils Lake, North Dakota | 2167 | 1514 | 1949 | 6089 | 5052 | 5820 | 9970 |
| Dodge City, Kansas | (a) | 1035 | 1116 | (a) | 2803 | 3068 | 5035 |
| Dubuque, Iowa | 1493 | 1336 | 1442 | 4251 | 3433 | 3976 | 6790 |
| Duluth, Minnesota | 1842 | 1489 | 1727 | 5496 | 4658 | 5216 | 9443 |
| Eastport, Maine | 1472 | 1390 | 1380 | 4404 | 4125 | 4270 | 8520** |
| Elkins, West Virginia | 921 | 1103 | 1048 | 3083 | 2975 | 3265 | 5697 |
| El Paso, Texas | 639 | 537 | 629 | 1468 | 1482 | 1667 | 2428 |
| Ely, Nevada | 1230 | 1289 | (a) | 4078 | 4460 | (a) | (a) |
| Erie, Pennsylvania | 1217 | 1168 | 1172 | 3455 | 2977 | 3336 | 6273 |
| Escanaba, Michigan | 1553 | 1425 | 1550 | 4752 | 4117 | 4688 | 8771* |
| Evansville, Indiana | 964 | 1069 | 949 | 2840 | 2619 | 2494 | 4244 |
| Fort Smith, Arkansas | 764 | 851 | 850 | 1948 | 1971 | 2027 | 3147 |
| Fort Wayne, Indiana | 1295 | 1225 | 1194 | 3846 | 3257 | 3405 | 5925 |
| Fort Worth, Texas | 625 | 683 | 580 | 1482 | 1535 | 1406 | 2148 |
| Fresno, California | 606 | 550 | 583 | 1648 | 1501 | 1494 | 2334 |
| Galveston, Texas | 363 | 413 | 353 | 667 | 794 | 683 | 1016 |
| Grand Junction, Colorado | 1011 | 1134 | 1233 | 2977 | 3293 | 3511 | 5548 |
| Grand Rapids, Michigan | 1348 | 1216 | 1262 | 3840 | 3205 | 3659 | 6535 |
| Green Bay, Wisconsin | 1590 | 1431 | 1538 | 4613 | 3835 | 4420 | 7825 |
| Greensboro, North Carolina | 748 | 883 | 772 | 2293 | 2166 | 2167 | 3529 |
| Greenville, South Carolina | 628 | 731 | 744 | 1851 | 1703 | 2078 | 3380 |
| Harrisburg, Pennsylvania | 1061 | 1115 | 1088 | 3107 | 2790 | 3069 | 5357 |
| Hartford, Connecticut | 1256 | 1237 | 1159 | 3603 | 3266 | 3316 | 6036 |
| Hatteras, North Carolina | 563 | 602 | 589 | 1330 | 1243 | 1316 | 2571 |
| Havre, Montana | 1898 | 1260 | 1624 | 5148 | 4342 | 4938 | 8700 |
| Helena, Montana | 1814 | 1709 | 1375 | 4841 | 4985 | 4433 | 7898 |
| Houston, Texas | (a) | 423 | 366 | (a) | 873 | 815 | 1157 |
| Huron, South Dakota | 1856 | 1314 | 1650 | 5101 | 3965 | 4735 | 8004 |
| Indianapolis, Indiana | 1141 | 1105 | 1128 | 3262 | 2722 | 3130 | 5298 |
| Ithaca, New York | 1322 | 1242 | 1256 | 3855 | 3400 | 3706 | 6719 |
| Kansas City, Missouri | 1134 | 1038 | 1141 | 3100 | 2602 | 3007 | 4956 |
| Kewanee, Illinois | 1396 | 1186 | 1223 | 4091 | 3051 | 3534 | 6139 |
| Knoxville, Tennessee | 701 | 848 | 815 | 2170 | 2046 | 2298 | 3670 |
| La Crosse, Wisconsin | 1708 | 1367 | 1535 | 4691 | 3720 | 4313 | 7322 |
| Lander, Wyoming | 1324 | 1680 | 1436 | 4407 | 4892 | 4511 | 7947 |

[1]Figures in this column are normal totals for a complete heating season, September to June, incl.

Figures in this table, with eight exceptions, based on local weather bureau reports. Exceptions are Utica, Lewiston, Kewanee, and Sioux City, figures for which are furnished through the courtesy of Coke Sales Department, Central New York Power Corp., Utica, N. Y.; Norman E. Ross, Bursar, Bates College, Lewiston, Me.; J. M. Hartman, Engineering Department, Kewanee Boiler Corp., Kewanee, Ill., and Alfred R. Wagstaff, Engineer, Sioux City Foundry and Boiler Co., Sioux City, Iowa, respectively; Anaconda, Bozeman, Butte and Livingston, Mont., through the courtesy of the Montana Power Company.

(a) Data not available.

[Table Concluded on Page 60

# How to eliminate these piping troubles that hamper war work:

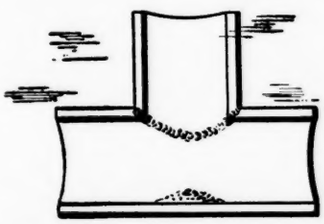
## Weld with TUBE-TURN WELDING FITTINGS

**VIBRATION EFFECTS**

You need never worry about vibration or strain loosening a *welded* joint.

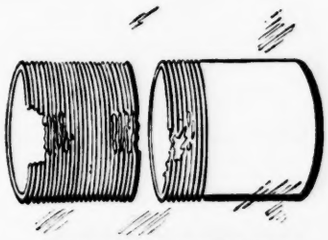
**GASKET CHANGES**

Fewer flanged joints mean less gaskets—save materials and time.



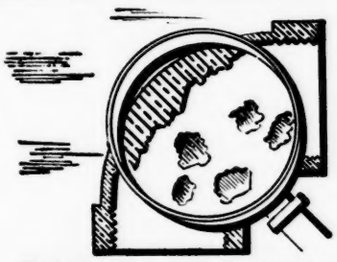
**SLAG ACCUMULATION**

Butt welds with Tube-Turn fittings virtually eliminate danger of slag.



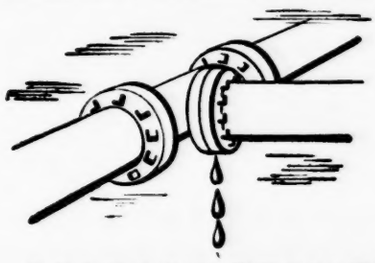
**WORN THREADS**

Threading thins and weakens metal—causes failures.



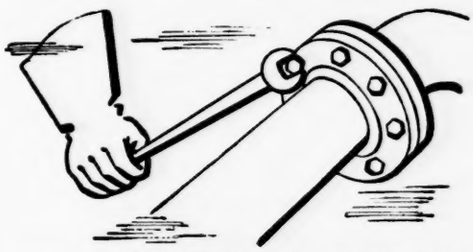
**RAPID CORROSION**

Tube-Turn fittings resist corrosion because of better metal structure.



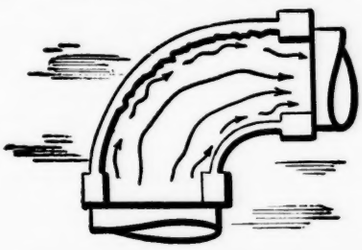
**LEAKAGE REPAIRS**

No chance of loose connections or leaks with Tube-Turn fittings.



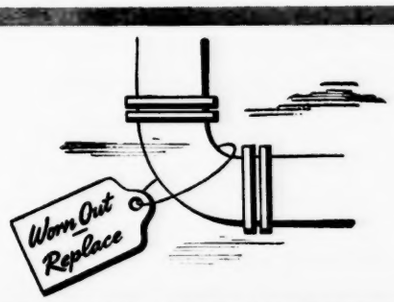
**LOOSENED BOLTS**

The more welding fittings used, the fewer bolts there are to tighten.



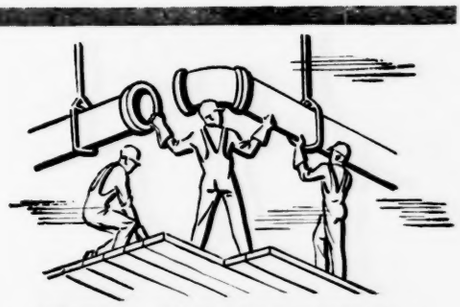
**INEFFICIENT FLOW**

Easy sweeping radius and no offsets inside mean less pressure loss.




**FITTING REPLACEMENT**

There's far less time loss or replacement expense with Tube-Turn welding fittings.



**SLOW INSTALLATION**

Tube-Turn fittings line up perfectly; allow fast, simple, easy butt welding.

NO. 3 OF A SERIES

HOW TUBE-TURN WELDING FITTINGS BENEFIT WAR INDUSTRY

The ★ FIRST WELDING FITTINGS 1ST AND STILL THE BEST

# TUBE-TURN

TRADE MARK

## Welding Fittings and Flanges

TUBE TURNS (INC.) LOUISVILLE, KY. *Branch offices:* New York, Chicago, Philadelphia, Pittsburgh, Cleveland, Dayton, Washington, D. C., Tulsa, Houston, Los Angeles. *Distributors in principal cities.*

# Degree-Days for January, 1943 (Concluded)

HEATING AND VENTILATING'S 15th year of publication of monthly degree-day data

| City | Monthly Degree-Days | | | Cumulative Degree-Days | | | Year[1] |
|---|---|---|---|---|---|---|---|
| | Degree-Days, Jan., 1943 | Degree-Days, Jan., 1942 | Degree-Days, Jan., Normal | Season, 9/1/42-1/31/43 | Season, 9/1/41-1/31/42 | Season, Normal 9/1-1/31 | Normal, 9/1-6/30 |
| Lansing, Michigan | 1413 | 1294 | 1336 | 4159 | 3452 | 4001 | 7048 |
| Lewiston, Maine | 1492 | 1416 | 1452 | 4438 | 4174 | 4289 | 7707 |
| Lincoln, Nebraska | 1339 | 1174 | 1311 | 3730 | 3210 | 3512 | 5999 |
| Little Rock, Arkansas | 721 | 782 | 719 | 1905 | 1871 | 1798 | 2811 |
| Livingston, Montana | 1398 | 1244 | 1220 | 4183 | 4212 | 3951 | 7205 |
| Los Angeles, California | 229 | 208 | 326 | 583 | 611 | 750 | 1504 |
| Louisville, Kentucky | 896 | 1000 | 939 | 2654 | 2371 | 2526 | 4180 |
| Lynchburg, Virginia | 741 | 851 | 856 | 2280 | 2075 | 2413 | 3980 |
| Macon, Georgia | 491 | 585 | 549 | 1338 | 1386 | 1446 | 2201 |
| Madison, Wisconsin | 1550 | 1385 | 1500 | 4494 | 3669 | 4258 | 7429 |
| Marquette, Michigan | 1551 | 1372 | 1500 | 4723 | 4112 | 4554 | 8693* |
| Memphis, Tennessee | 732 | 873 | 744 | 1907 | 2051 | 1871 | 2950 |
| Meridian, Mississippi | 522 | 673 | 552 | 1351 | 1515 | 1435 | 2160 |
| Milwaukee, Wisconsin | 1439 | 1400 | 1383 | 4304 | 3655 | 3984 | 7245 |
| Minneapolis, Minnesota | 1771 | 1379 | 1609 | 4989 | 4013 | 4550 | 7850 |
| Modena, Utah | 1095 | 1282 | 1187 | 3477 | 4017 | 3859 | 6562 |
| Montgomery, Alabama | 448 | 591 | 515 | 1161 | 1265 | 1284 | 1884 |
| Nantucket, Massachusetts | 1100 | 1044 | 1026 | 3075 | 2766 | 2938 | 5957 |
| Nashville, Tennessee | 760 | 889 | 812 | 2151 | 2063 | 2175 | 3507 |
| New Haven, Connecticut | 1166 | 1131 | 1110 | 3297 | 2891 | 3219 | 5895 |
| New Orleans, Louisiana | 361 | 420 | 332 | 739 | 809 | 735 | 1024 |
| New York, New York | 1058 | 1056 | 1060 | 2902 | 2588 | 2909 | 5347 |
| Nome, Alaska‡ | 2209 | 1591 | 1857 | 5485 | 4564 | 5236 | 14580** |
| Norfolk, Virginia | 675 | 742 | 738 | 1772 | 1632 | 1933 | 3350 |
| Northfield, Vermont | 1634 | 1471 | 1544 | 4840 | 4446 | 4798 | 8719* |
| North Head, Washington | 799 | 667 | 725 | 2510 | 2239 | 2510 | 5452** |
| North Platte, Nebraska | 1212 | 1205 | 1300 | 3636 | 3516 | 3786 | 6366 |
| Oakland, California | 507 | 472 | 527 | 1596 | 1443 | 1626 | 3143** |
| Oklahoma City, Oklahoma | 859 | 839 | 865 | 2217 | 2083 | 2244 | 3613 |
| Omaha, Nebraska | 1396 | 1233 | 1355 | 3881 | 3361 | 3639 | 6131 |
| Oswego, New York | 1384 | 1277 | 1277 | 3924 | 3507 | 3771 | 7088 |
| Parkersburg, West Virginia | 909 | 1026 | 992 | 2812 | 2597 | 2822 | 4775 |
| Peoria, Illinois | 1262 | 1224 | 1283 | 3731 | 3069 | 3606 | 6109 |
| Philadelphia, Pennsylvania | 1002 | 1008 | 1001 | 2762 | 2400 | 2736 | 4855 |
| Phoenix, Arizona | 358 | 326 | 409 | 734 | 814 | 990 | 1405 |
| Pittsburgh, Pennsylvania | 985 | 1031 | 1054 | 2988 | 2653 | 3003 | 5235 |
| Pocatello, Idaho | 1182 | 1480 | 1218 | 3728 | 4373 | 3867 | 6655 |
| Portland, Maine | 1473 | 1368 | 1162 | 4329 | 3959 | 5088 | 7218 |
| Portland, Oregon | 928 | 880 | 806 | 2416 | 2392 | 2530 | 4469 |
| Providence, Rhode Island | 1177 | 1117 | 1116 | 3319 | 2987 | 3246 | 6015 |
| Pueblo, Colorado | 1010 | 1133 | 1060 | 3094 | 3372 | 3224 | 5514 |
| Raleigh, North Carolina | 675 | 756 | 722 | 1927 | 1744 | 1975 | 3234 |
| Rapid City, South Dakota | 1591 | 1143 | 1320 | 4372 | 3698 | 4021 | 7118 |
| Reading, Pennsylvania | 1044 | 1083 | 1088 | 3039 | 2695 | 3102 | 5389 |
| Redding, California | 540 | 537 | 614 | 1594 | 1514 | 1533 | 2451 |
| Reno, Nevada | 950 | 1129 | 1042 | 3079 | 3302 | 3326 | 5892 |
| Richmond, Virginia | 767 | 876 | 831 | 2216 | 2053 | 2211 | 3695 |
| Rochester, New York | 1379 | 1257 | 1252 | 3954 | 3461 | 3666 | 6732 |
| Roseburg, Oregon | 809 | 678 | 744 | 2233 | 2237 | 2485 | 4428 |
| Roswell, New Mexico | 709 | 773 | 786 | 1902 | 2104 | 2296 | 3484 |
| Sacramento, California | (a) | 587 | 614 | (a) | 1499 | 1610 | 2653 |
| St. Joseph, Missouri | 1221 | 1136 | 1187 | 3363 | 2879 | 3147 | 5161 |
| St. Louis, Missouri | 1022 | 1007 | 1060 | 2809 | 2447 | 2798 | 4585 |
| Salt Lake City, Utah | 1055 | 1379 | 1110 | 3264 | 3550 | 3259 | 5555 |
| San Antonio, Texas | (a) | 464 | 381 | (a) | 1001 | 854 | 1202 |
| San Diego, California | 251 | 221 | 332 | 640 | 571 | 819 | 1645 |
| Sandusky, Ohio | 1197 | 1146 | 1181 | 3483 | 2936 | 3323 | 6208 |
| San Francisco, California | 405 | 431 | 465 | 1364 | 1220 | 1414 | 3264** |
| Sault Ste. Marie, Michigan | 164 | 1565 | 1581 | 3609 | 4655 | 4828 | 9285** |
| Savannah, Georgia | 376 | 415 | 409 | 921 | 843 | 1007 | 1490 |
| Scranton, Pennsylvania | 1212 | 1194 | 1172 | 3573 | 3161 | 3446 | 6129 |
| Seattle, Washington | 883 | 688 | 781 | 2513 | 2320 | 2650 | 4934** |
| Sheridan, Wyoming | 1444 | 1270 | 1431 | 4262 | 4298 | 4629 | 8008 |
| Shreveport, Louisiana | 545 | 622 | 555 | 1354 | 1466 | 1324 | 1938 |
| Sioux City, Iowa | 1567 | 1326 | 1435 | 4449 | 3716 | 4018 | 6898 |
| Spokane, Washington | 1341 | 1312 | 1172 | 3824 | 3854 | 3755 | 6355 |
| Springfield, Illinois | 1159 | 1111 | 1181 | 3316 | 2766 | 3183 | 5373 |
| Springfield, Missouri | 993 | 1044 | 973 | 2772 | 2660 | 2647 | 4428 |
| Syracuse, New York | 1420 | 1265 | 1277 | 4020 | 3499 | 3768 | 6893 |
| Tacoma, Washington | 931 | 772 | 812 | 2685 | 2568 | 2763 | 5181** |
| Terre Haute, Indiana | 1075 | 1090 | 1070 | 3130 | 2679 | 2910 | 4872 |
| Toledo, Ohio | 1285 | 1194 | 1203 | 3704 | 3086 | 3392 | 6077 |
| Topeka, Kansas | 1145 | 1056 | 1135 | 3127 | 2698 | 3018 | 4969 |
| Trenton, New Jersey | 1057 | 1076 | 1014 | 3004 | 2665 | 2774 | 4933 |
| Utica, New York | 1510 | 1335 | 1248 | 4238 | 3695 | 3785 | 6796 |
| Valentine, Nebraska | 1511 | 1275 | 1370 | 4289 | 3821 | 4095 | 7039 |
| Walla Walla, Washington | 1189 | 1276 | 989 | 2990 | 3113 | 2898 | 4808 |
| Washington, D. C. | 894 | 936 | 970 | 2547 | 2242 | 2711 | 4626 |
| Wichita, Kansas | 1087 | 1023 | 1094 | 2964 | 2654 | 2877 | 4673 |
| Williston, North Dakota | 2058 | 1406 | 1805 | 5636 | 4606 | 5463 | 9323 |
| Winnemucca, Nevada | 1027 | 1215 | 1150 | 3324 | 3670 | 3739 | 6427** |
| Yakima, Washington | 1313 | 1229 | 1159 | 3610 | 3407 | 3587 | 5599 |

‡Nome data are for December.

*Includes August. **Includes July and August.

[1]Figures in this column are normal totals for a complete heating season, September to June, incl.

(a) Data not available.

# IT'S GOT ALMOST EVERYTHING

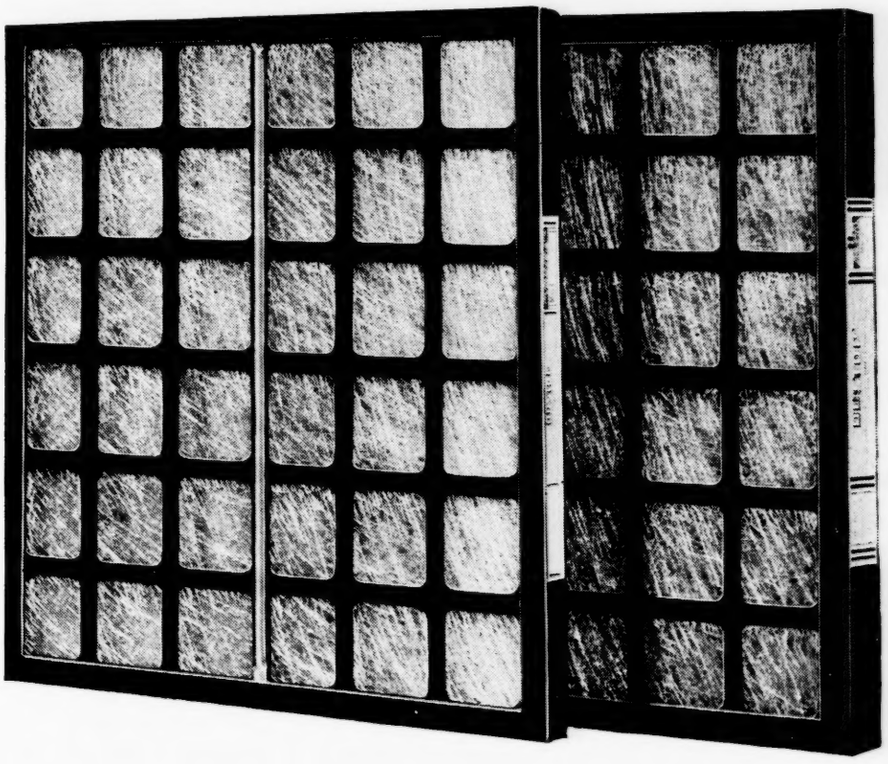
## *Dust-Stop's new "war filter" retains most advantages of former filter*

**Precision manufacture** means dust control in air-conditioning and mechanical ventilation systems.

To many bomber, tank, instrument, and other war plants—this means Dust-Stops.*

And this increased demand, greater than ever before, has been met by Dust-Stop engineers. On the market now is the new "war filter." Quickly available! Price and maintenance economy unchanged! Same filtering efficiency!

AND IT'S MADE FROM NON-CRITICAL MATERIALS!



*Above, the former filter. To right, new "war filter." Square-holed grill of heavy Kraft cardboard replaces metal, round-holed grill.*

### Look at "war filter's" advantages

**PERFORMANCE:** Capacity 2 CFM per sq. in. of area at 300 FPM. Average resistance, new, in inches of water gauge, .065 for 1-inch, .13 for 2-inch.

**ECONOMY:** Cost only 1¢ per CFM as original equipment for industrial installations. Less than 1/10 of 1¢ per CFM to replace.

**MAINTENANCE:** Filter face can be vacuum cleaned or rapped out; this practice can be repeated once or twice, further reducing maintenance costs.

**EASY TO CHANGE:** Anyone can replace dirty filters with new Dust-Stops in a jiffy.

**AVAILABILITY:** Made from all-American materials which are not now listed as critical. Production is being expanded to meet growing requirements.

**WHAT ABOUT FIRE-SAFETY?:** The famous non-inflammable Dust-Stop adhesive is no longer available. As a substitute, standard filter adhesives are now used. The filter media is still made of incombustible glass fibers.

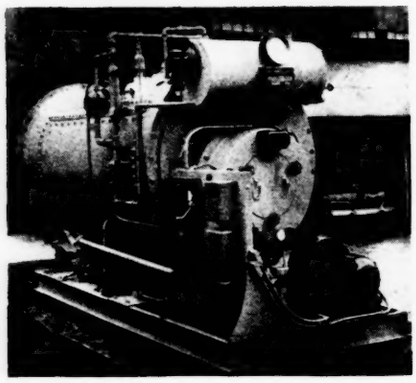
• • • •

*Owens-Corning Fiberglas Corporation, Toledo, Ohio. In Canada, Fiberglas Canada, Ltd., Oshawa, Ontario.*

## FIBERGLAS* DUSTOP* AIR FILTERS

*T. M. Reg. U.S. Pat. Off.

# NEW EQUIPMENT

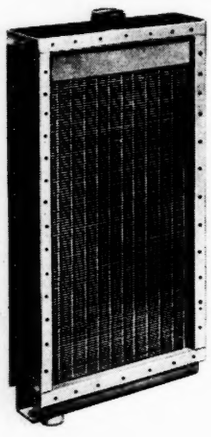


### Steam Generator

NAME—Type FR steam generator.
PURPOSE—For rapid steam generation in process work.
FEATURES—This forced recirculator type of generating unit is mounted on a rigid steel chassis complete with oil burner and all of the auxiliary equipment and controls necessary for self-contained automatic operation, requiring only connection to electric, fuel oil, and fresh water supply lines. Unit is of Scotch Marine design and is compactly assembled, with all piping, auxiliaries, and controls entirely contained within the dimensions of the chassis. Rugged construction and an extremely low space, weight, and horsepower relationship are claimed for the unit. Stack or chimney not needed.
SIZES—From 20 to 300 hp and working pressures up to 200 lb per sq in.
MADE BY—*The International Boiler Works Co., East Stroudsburg, Pa.*

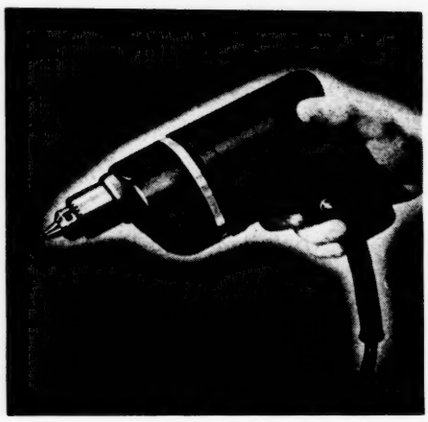
### Steel Fin Coils

NAME—Modine steel heating coils.
PURPOSE—For air heating in heating, ventilating, air conditioning or process work.

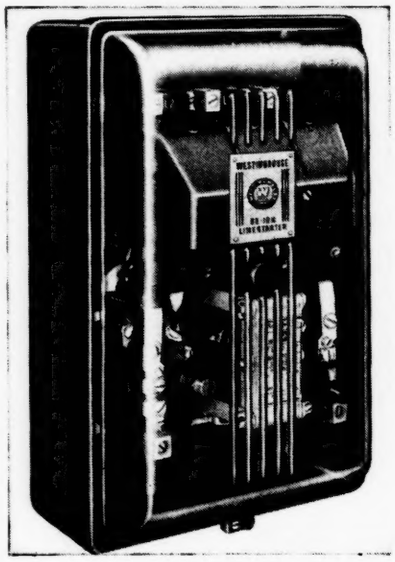


FEATURES—Employing steel construction throughout, with fins bonded permanently to tubes by immersion in a lead alloy bath, long life, freedom from corrosion and effective heat transfer are claimed for these heaters. Fins are formed to a patented design by special dies, this construction lending turbulence to the air travel between fins and giving a high rate of heat transfer. Casings designed for duct installation in end-vertical, side-vertical, or horizontal position. Tubes have heavy wall thicknesses to insure maximum resistance to internal corrosion and to withstand high pressure. All coils guaranteed at 150 lb per sq in steam operating pressure, tested hydrostatically at 500 lb.
SIZES—Three casing widths, 21¼, 29 and 37¾ in.; thirteen casing lengths ranging from 2 ft 8½ in. to 10 ft 8½ in. Several standard fin spacings and tube depths.
MADE BY—*Modine Manufacturing Co., Racine, Wis.*

### Plastic Drill



NAME—Thor U14K plastic drill.
PURPOSE—For ordinary drill applications and to save critical metals.
FEATURES—With grip handle, gear case, and field case made of the new tough light weight plastic Thorite, this drill is claimed to have more power per pound, greater strength and protection from shock, and to be more compact, lighter in weight, and cooler to handle than former types of machines. Chuck takes any drill up to ¼ in. Product has been in Army use for nearly a year and is said to have proved itself under severe field conditions. Furnished in maroon color for civilian uses.
MADE BY—*Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago, Ill.*

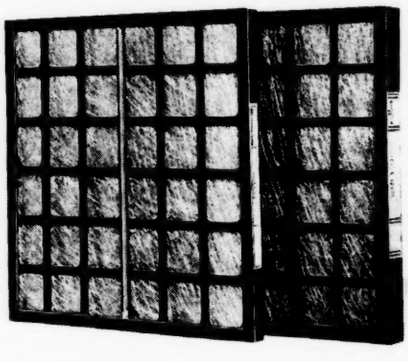


### Westinghouse Linestarter

NAME—Size 2 Class 11-200 linestarter.
PURPOSE—For machine tools, pumps, fans, and similar equipment.
FEATURES—Compactness to facilitate group mountings and built-in applications is claimed for this new starter, which has a new clapper type armature with knife edge bearings, double break silver-to-silver contacts and overload relays, reset either by hand or automatically. Provision can be made for four normally open or normally closed interlocks.
MADE BY—*Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.*

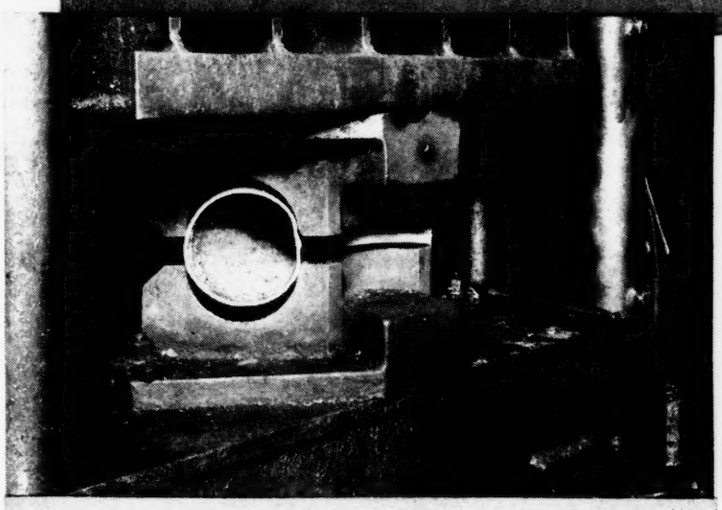
### Fiberglas Filter

NAME—Dust-Stop war filter.
PURPOSE—For filtering air and to save critical materials.
FEATURES—Has heavy Kraft cardboard grille with square openings in place of the former metal with round openings, and a standard filter adhesive in place of the formerly-used non-inflammable Dust-Stop adhesive which is no longer available.
MADE BY—*Owens-Corning Fiberglas Corp., Toledo, Ohio.*

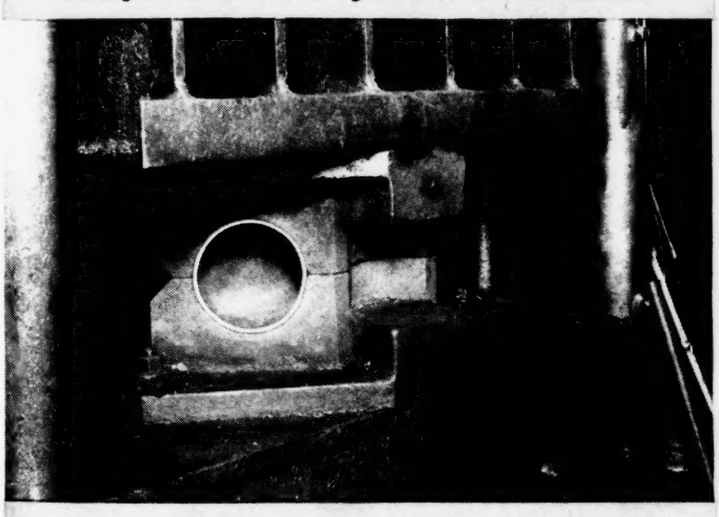


# MIDWEST BUTT-WELDING ELBOWS

## Have Greater Dimensional Accuracy and Uniformity



*(Above) Oversize Midwest Elbow has been reheated and placed in sizing die for reduction to exact size and shape. Dies have just started to compress 8" elbow having circumference ½" greater than when finished.*



*Showing the sizing operation completed. The Midwest Welding Elbow now has true circular cross section, uniform wall thickness, and accurate radius, included arc and tangents.*

*Because*

## They are SIZED IN COMPRESSION

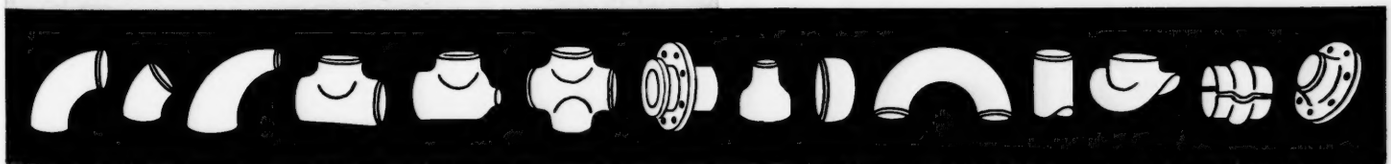
This exclusive Midwest feature is very important to all users of welding elbows because it (1) saves time (and therefore money) in lining up pipe and elbow, (2) saves welding time, and (3) assures more uniform welds.

This feature results from the unique process for manufacturing Midwest Welding Elbows. The Midwest Elbow is first made slightly oversize . . . it is then reheated and reduced to accurate size and shape by a final working of the metal in *compression* at a forging heat—it is not extruded or stretched.

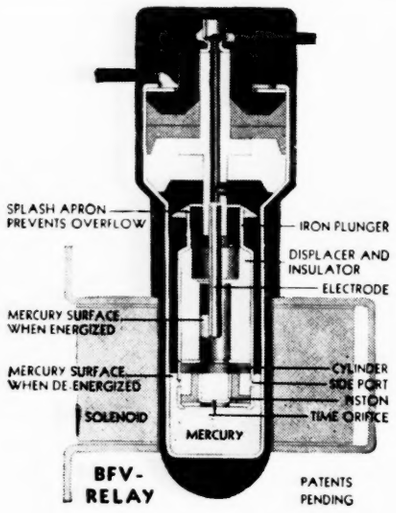
This feature applies to all Midwest Welding Elbows—both American Standard and "Long Tangent." See Bulletin WF-41 for details regarding the many other advantages of Midwest Welding Fittings.

**MIDWEST PIPING & SUPPLY CO., INC.**

**Main Office: 1450 S. Second St., St. Louis, Mo.**
Plants: St. Louis, Passaic (N.J.) and Los Angeles
Sales Offices: Chicago—645 Marquette Bldg. • Houston—229 Shell Bldg. • Los Angeles—520 Anderson St. • New York—(Eastern Division) 30 Church St. • San Francisco—535 Call Bldg. • Tulsa—533 Mayo Bldg.



MIDWEST WELDING FITTINGS SAVE TIME, IMPROVE THE DESIGN, AND REDUCE THE COST OF PIPING SYSTEMS




## Hermetically Sealed Relay

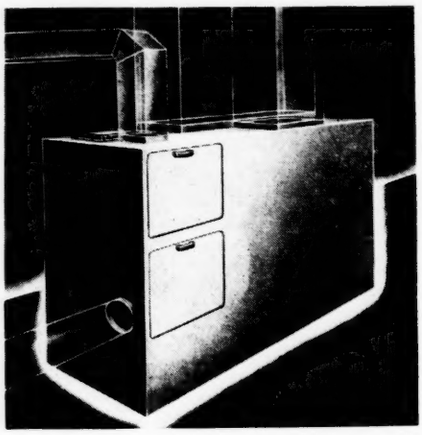
NAME—Series BFV Durakool time relay.
PURPOSE—For electrical relay applications in dirty, moist, or explosive atmospheres.
FEATURES—Make and break contact is made between electrode and mercury in hermetically-sealed inert-gas-filled chamber. A floating iron plunger, actuated by an external solenoid, raises the mercury level by forcing through a pre-determined orifice, thus making contact with the electrode. Inert gas claimed to completely prevent oxidization of contact surface and thus to eliminate changes in time cycle due to burning and shortening of elements. Normally-open, normally-closed, time delay on opening or closing or both, or various other combinations furnished if desired. Solenoids wound to meet any voltage and frequency.
SIZES—Up to 75 amperes.
MADE BY—*Durakool, Inc., 1010 North Main Street, Elkhart, Ind.*

## Synthetic Isolators

NAME — Ameripol Vibro-Insulators.
PURPOSE—For isolation and insulation of vibration, shock, and noise.
FEATURES — Using Ameripol synthetic rubber bonded to metal these new mountings are expected to find wide application where oils, grease, paint, fatty acids, or heat, would cause too rapid deterioration of the natural rubber product. The synthetic units, like the natural rubber type, are designed to carry the load in shear since the resiliency of rubber in shear is six times as great as in compression.
MADE BY—*B. F. Goodrich Company, Akron, Ohio.*

## Humidifying Unit

NAME—Kathabar humidity control package unit.
PURPOSE—For control of humidity in laboratories, storage rooms, or local working areas in factories.
FEATURES—Using same operating principle and design as used in large central type of systems ranging in capacity up to 100,000 cfm, this assembled portable unit comes ready for easy connection to steam, water and electric lines. Air is dehumidified by passing through sprayed Kathene solution, which is a single salt of low vapor pressure, the solution acting as a chemical absorption medium. The salt is said to be non-corrosive and to give actual protection to metal surfaces; also, to be free from deterioration due to age. Part of the solution is continually regenerated during operation and, since it is continually filtered, can be used in dust laden atmospheres. System has only two moving parts and ready accessibility to these is provided by two doors at the sides of the unit.
SIZES & CAPACITIES—Four standard units in capacities of 750 to 5000 cfm, weighing 1600 to 4800 lb.
MADE BY—*Surface Combustion, Toledo, Ohio.*



## Air Filter

NAME—Type AD filter cartridge.
PURPOSE—For protection of workers against inhalation of industrial dusts.
FEATURES—This new cartridge is one of seven interchangeable filter units used in the face-piece of the company's AO R-1000 respirator. It is said to give complete protection against a combination of all types of dusts, including toxic and nuisance dusts.
MADE BY — *American Optical Company, Southbridge, Mass.*

## Roof Ventilators

NAME—NCM roof ventilators.
PURPOSE — For factory ventilation and to save critical metals.
FEATURES — In line with WPB restrictions, these new ventilators use less than 5% metal, this being for bracing and assembling. Some of the new designs closely resemble the original steel units and are said to be equal in performance. The gravity type are made of tough rigid fiber sheets thoroughly impregnated with water-proofing compound and given a surface treatment of sand and paint to insure durability. Fan type units are made of pressed wood securely fastened to a framework and finished with one primer and one finished coat of weather-resisting paint. The insides of both types of units are painted black to aid blackout uses and the outsides are in an Army drab color meeting Federal specifications.
LITERATURE—Catalog No. 217.
MADE BY—*The Swartwout Company, 18511 Euclid Ave., Cleveland, Ohio.*

## Humidifier

NAME—Skilbeck "E-Humidifier."
PURPOSE — For humidification of factories, offices, and institutions.
FEATURES—Installed on supply end of radiators, or on steam risers at points where the condensate will return to the boiler when radiators are turned off, this unit will automatically diffuse the correct amount of moisture into the air, according to the manufacturer. It is intended for use on steam heating systems using 20 lb pressure or less.
MADE BY — *Techtmann Industries, Inc., 828 N. Broadway, Milwaukee, Wis.*

**FOR LOW-COST HEATING, QUICK INSTALLATION AND METAL CONSERVATION**

# DIRECTHERM
## UNIT HEATERS
## STOKER-FIRED

It is a self-contained unit and can be installed or moved in a few hours. No duct work, radiators, or pipes are necessary.

To tend a Directherm requires a minimum of attention. Once the automatic controls are set, they need not be changed. An unskilled man can take care of it . . . important in these days of labor shortage.

Made in 6 sizes (300,000-1,700,000 BTU).

# AIRTHERM
## MANUFACTURING COMPANY

**722 S. SPRING AVE., ST. LOUIS, MO.**

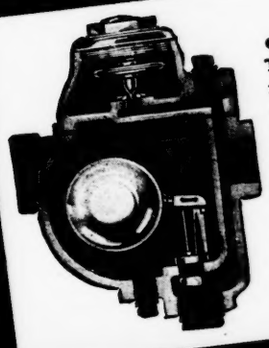
---

## The scene has changed ... but not the requirements

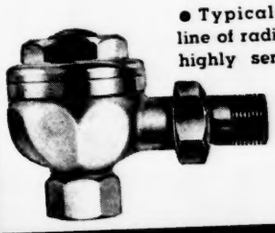
● Valves, traps, vents, gauges and thermometers are being used on a larger scale than ever before—not in the same places, but in the same way. Jobs are fewer; but they are larger . . . and for the first time in any of our lives EVERY job is VITAL.

Since it is vital, it calls for the best; and to those who know practical, on-the-job dependability, that means Marsh Equipment. By anticipating the design changes called for by material restrictions, Marsh Products are being made available for practically any essential use.

**JAS. P. MARSH CORPORATION**
**2089 Southport Ave.**
**Chicago, Ill.**



● The No. 12 Drip Trap — ideal for rapid air and condensation removal from short mains, unit heaters, coils, etc. Typical of complete line of floats and thermostatic traps and non-airbinding bucket traps.



● Typical of complete line of radiator traps with highly sensitive thermostatic elements both diaphragm and bellows types.

● A real packless valve with Marsh exclusive metal-to-metal seal. All patterns.

# MARSH
## QUALITY HEATING SPECIALTIES SINCE 1865

FULL STEAM AHEAD

# MEETS SPECIFICATIONS OF

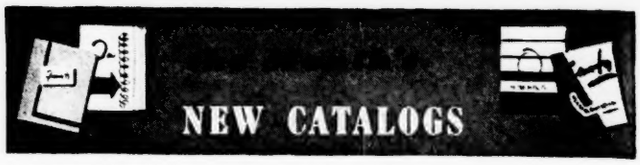
**In Army and Navy Air Bases, army camps and in important defense plants, ADSCO Internally - Externally Guided Joints are safeguarding vital steam, hot water, fuel oil and gasoline lines. Completely guided, these joints meet Army and Navy specifications for controlling expansion and contraction in pipe lines. Approved by leading mechanical engineers.**

**Write for quotations, also Bulletin 35-20V.**

AMERICAN DISTRICT STEAM COMPANY
NORTH TONAWANDA N. Y.

Making "UP-TO-DATE" Steam Line Equipment for Over 60 Years

ADSCO INTERNALLY EXTERNALLY GUIDED JOINTS


## MOTORS

**Allis-Charmers Mfg. Co., Milwaukee, Wis.**

An ingenious new pocket size slide-rule type of motor selector is available free from the manufacturer upon application on a company letterhead. With it the motor user can match the operating conditions which the motor will have to meet against various motor characteristics, and thus instantly select the right motor for the job.

## FEEDWATER TESTING

**Worthington Pump and Machinery Corporation, Newark, New Jersey.**

Bulletin W-210-B28, standard size, 4 pages, illustrates and describes the type 01 dissolved oxygen portable test kit which employs the Winkler method for determining the dissolved oxygen content of deaerated boiler feedwater. A counter current sample cooler also is described.

## ALUMINUM WELDING

**Aluminum Company of America, Pittsburgh, Pa.**

"Welding and Brazing ALCOA Aluminum" is a beautifully illustrated, 100 page, spirally bound booklet giving complete descriptive matter on gas, arc, and electric-resistance welding with a section devoted to aluminum brazing. The booklet is a completely rewritten edition of the company's original welding booklet.

## VENTILATION

**Ilg Electric Ventilating Co., 2850 N. Crawford Ave., Chicago, Ill.**

Issuance of a new binder form of catalog containing 11 "Proof of Result" bulletins distributed during the past year, is announced by the company. Each bulletin is devoted to a specific heating or ventilating problem together with the solution. Binder size 8½ x 11 in.

## TEMPERATURE CONTROL

**Marsh Tritrol Company, 600 S. Michigan Ave., Chicago.**

A 12-page, standard size catalog, liberally illustrated with charts and diagrams, presents detailed information on the Tritrol regulator. It is especially intended as an aid to heating men in working out some of the problems presented by fuel rationing.

## COMPRESSORS AND PUMPS

**The Allis-Chalmers Manufacturing Co., Milwaukee, Wis.**

Bulletin B-6211, standard size, 20 pages, gives a complete engineering description of the Ro-Flo light weight sliding vane type of compressors and pumps. Installation diagrams, sectional views, photographs, and curves showing the relationship between pressure, temperature and volume, supplement the engineering data.

### INSULATION

**J. W. Mortell Company, Kankakee, Ill.**

A new 32 page, 4 x 7 in., handbook, illustrates and describes application of the company's NoDrip plastic cork coating for prevention of condensation.

### CONTROLS

**Zenith Electric Company, 152 W. Walton St., Chicago.**

An 8-page standard size catalog, illustrates and describes magnetic contactors, control switches, automatic re-set timers, and similar equipment.

ARMY – NAVY

AWARDS

Ilg Electric Ventilating Co.
Chicago, Ill.

Penn Electric Switch Co.
Goshen, Ind.

Union Asbestos & Rubber Co.
Chicago, Ill.

Corning Glass Works, Corning Divisions
Corning, N. Y.

Buffalo Pumps, Incorporated
New York, N. Y. (Award renewal)

The Formica Insulation Co.
Cincinnati, Ohio.

Jenkins Bros.
New York, N. Y.

Caterpillar Tractor Co.
Peoria, Ill.

Minneapolis-Honeywell Regulator Co.
Minneapolis, Minn. (Award No. 2)

Armstrong Cork Co.
Lancaster, Pa.

Bryant Heater Co.
Cleveland, Ohio.

The Austin Co.
Cleveland, Ohio.

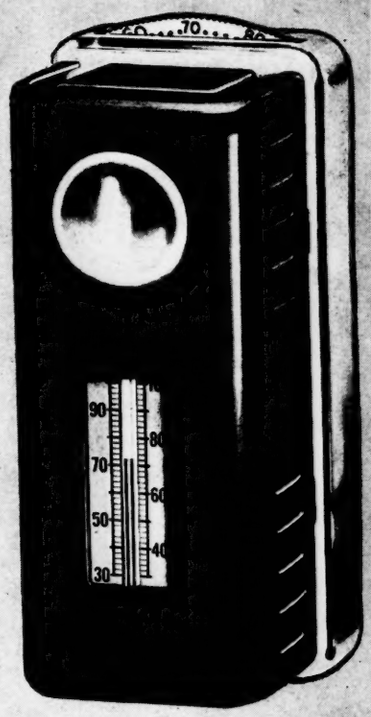
Babcock & Wilcox, Refractories Division
Augusta, Ga.

## WITH THE MANUFACTURERS

### LINDSAY AND LINDSAY

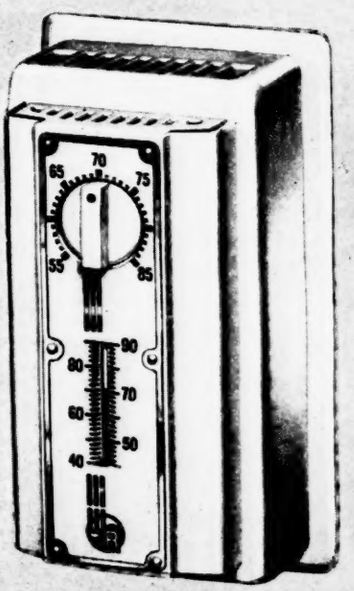
222 W. Adams St., Chicago, and 60 E. 42nd St., New York, is the successor to the Lindsay Structure Division of Dry-Zero Corporation, Chicago, and effective February 1 will manufacture and sell Lindsay Structure.


**WHITE-RODGERS THERMOSTATS**



White-Rodgers Series 150 Thermostats are being extensively used in War Plants, Naval Stations and Army Camps for the control of unit heating and cooling equipment. The reliable performance of these heavy-duty line-voltage thermostats is due to exceptionally sturdy construction plus the time-tested accuracy of the Hydraulic-Action principle of temperature control.

HYDRAULIC ACTION CONTROL



White-Rodgers Series 180 Thermostats are widely used in similar military and naval installations where lower current ratings are permissible. An improved type bimetallic element, extremely sensitive to temperature changes, operates a double-contact switch mechanism housed in a protective steel case.

**WHITE-RODGERS ELECTRIC CO.**

*Controls for Heating • Refrigeration • Air-Conditioning*

**1207c CASS AVENUE • ST. LOUIS, MISSOURI**

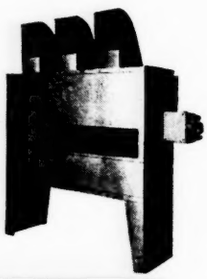
# For Army-Navy Projects and War Industries

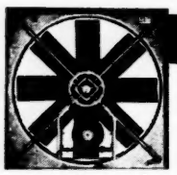
**At this time The Herman Nelson Corporation is busy furnishing Heating, Ventilating and Air Conditioning Equipment for use everywhere in connection with work vital to our National War Effort. However, The Herman Nelson Corporation is maintaining Sales and Service Offices in all Principal Cities in order to help facilitate war work. Each office is equipped to quote and aid in working out details for your war project.**

**HERMAN NELSON hijet HEATERS**

**Horizontal Shaft Propeller-Fan Type hijet Heater** projects warm air downward in the desired direction. Eliminates waste fuel and space. Available in 48 models, sizes and arrangements.

**Herman Nelson Blower-Fan Type hijet Heater** provides efficient heating of large areas. Streamline discharge outlets maintain large air delivery with high velocity. For floor, wall, ceiling, or inverted wall mounting. Available in 150 models, sizes and arrangements with a wide range of capacities.

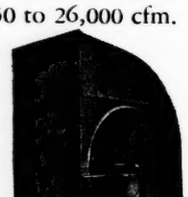




**AUTOVENT FANS AND BLOWERS**

**Autovent Propeller Fan.** Exclusive Autovent design—direct or belt driven. Ruggedly constructed for economical operation under severe conditions. Available in wheel diameters from 9 to 54 inches; capacities 450 to 26,000 cfm.

**Autovent Blower** for heavy duty ventilating and air conditioning installations. This Blower can be furnished to any speed or discharge requirements, in a wide range of sizes.



**Sales and Service Offices in Following Principal Cities**

| | | |
|---|---|---|
| Albuquerque, N. Mex. | Indianapolis, Ind. | Philadelphia, Pa. |
| Atlanta, Ga. | Jackson, Miss. | Pittsburgh, Pa. |
| Baltimore, Md. | Johnstown, Pa. | Portland, Maine |
| Birmingham, Ala. | Kansas City, Mo. | Richmond, Va. |
| Boston, Mass. | Los Angeles, Calif. | Saginaw, Mich. |
| Buffalo, N. Y. | Louisville, Ky. | Salt Lake City, Utah |
| Charlotte, N. C. | Madison, Wis. | San Antonio, Texas |
| Chicago, Ill. | Memphis, Tenn. | San Francisco, Calif. |
| Cincinnati, Ohio | Miami, Fla. | Scranton, Pa. |
| Cleveland, Ohio | Milwaukee, Wis. | Seattle, Wash. |
| Columbus, Ohio | Minneapolis, Minn. | Spokane, Wash. |
| Dallas, Texas | Missoula, Mont. | St. Louis, Mo. |
| Denver, Colo. | Moline, Ill. | Syracuse, N. Y. |
| El Paso, Texas | Nashville, Tenn. | Tucson, Ariz. |
| Emporia, Kans. | New Orleans, La. | Tulsa, Okla. |
| Fort Wayne, Ind. | New York City, N. Y. | Washington, D. C. |
| Grand Rapids, Mich. | Norfolk, Va. | Watervliet, N. Y. |
| Houston, Texas | Omaha, Neb. | Westfield, Mass. |

**THE HERMAN NELSON CORPORATION, MOLINE, ILLINOIS**

**Autovent Fan & Blower Division, Chicago, Illinois**

***Manufacturers of Quality Heating, Ventilating and Air Conditioning Products***


## HENRY VALVE COMPANY

*Hal McPherson*

has appointed Hal McPherson as chief engineer. Mr. McPherson has been associated with the refrigeration and air conditioning industry for over twenty years, and has been responsible for a number of important developments in the industry. He has been active and has held local and national offices in the A.S.R.E. for a number of years.

## AMERICAN AUTOMATIC HEATING CORP.

152 West 42nd Street, New York, has been organized to specialize in oil to coal conversion problems in the metropolitan New York area. Officers include H. W. Clarke, president; L. J. Kennedy, vice president; W. C. Stohldrier, secretary-treasurer; and Otto Kuhler, consulting engineer. Mr. Clarke was formerly publisher of *Coal-Age*. The corporation will specialize in plants where the boiler unit ranges from low pressure to 200 boiler hp.

## THE BRISTOL COMPANY

Waterbury, Conn., manufacturers of automatic control and recording instruments, announces the appointment of L. G. Bean as vice president in charge of engineering and sales. Mr. Bean has held the position of vice president and general sales manager since 1939. Harry E. Bean who joined the company in 1920 and since 1936 has been field sales manager in charge of branches at Chicago, Akron and San Francisco, has been named sales manager with headquarters in Waterbury. E. L. Stilson, a member of the field engineering department for the last three years has been named assistant sales manager.

## PEERLESS PUMP DIVISION

of Food Machinery Corporation, announces the appointment of Dan R. Rankin as acting chief engineer of the company. Rankin has been associated with Peerless for the past five years and previously was assistant to the chief engineer. Continuous research in the field of hydraulics is being carried out under Rankin's direction in the recently enlarged Peerless laboratory, and he is credited with many developments and innovations in pump design.

## BROWN INSTRUMENT DIVISION

of the Minneapolis-Honeywell Regulator Co., has leased the former Manheim Trust Company Building in Philadelphia and will occupy the new quarters on March 1. The additional space is required for work on war contracts. District sales offices of Minneapolis-Honeywell will be moved from their present location in Philadelphia to the new quarters, along with some Brown non-production departments. The space thus vacated will be utilized to make room for expanded production.

### FOSTER WHEELER CORPORATION

has elected P. W. Foster, Jr., to the office of vice president.

### AIR FILTER INSTITUTE

is the new name of the National Association of Air Filter Manufacturers which recently met in Chicago. The following officers of the Institute were elected: Charles G. Lamb, president, Detroit Air Filter Co.; Cliff Rowley, vice-president, Owens-Corning Fiberglas Co.; and J. R. McConnell, secretary-treasurer, American Air Filter Co.

### W. M. WHITING CORPORATION

Harvey, Ill., entertained its supervisors at the Del Prado Hotel, Chicago, December 9 in recognition of their breaking all production records during October.

### THE AUSTIN COMPANY

Cleveland, Ohio, has named W. G. Paton of Cleveland and W. R. Engstrom of Seattle, vice presidents according to an announcement by George A. Bryant, president and general manager. Mr. Paton has been with the Austin organization since 1919, serving since 1938 as assistant to the general manager. In addition to his new position as vice president he is also assuming the post of assistant secretary and assistant treasurer of the company. Mr. Engstrom joined the organization in 1925 in the Seattle territory, became district manager in 1933 and since mid-1940 has been the company's general project manager on the U. S. Naval Air Station and Naval Supply Depot, Seattle, and related navy construction work in the Northwest.

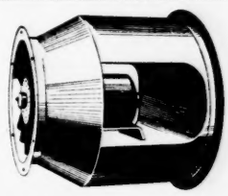
### JOSHUA HENDY IRON WORKS

Sunnyvale, California, announces the acquisition of the Crocker-Wheeler Electric Manufacturing Company, Ampere, N. J., as well as the Pomona Pump Company, Pomona, California, with its subsidiary, Westco Pump Division, Bettendorf, Iowa. Plans of the parent company call for a large expansion of the Crocker-Wheeler Company under the management of A. J. M. Baker, former deputy director general of the British Purchasing Commission and chief of the Machine Tool Division. The entire executive personnel of Pomona Pump Company will be retained intact. In addition to the locations mentioned the company has new plants at Torrance and Long Beach, California, and its products will include marine engines, steam turbines, turbo-generators, motors, pumps, ship fittings and other equipment for the Maritime Commission.

### THE FEDDERS-NEW YORK COMPANY

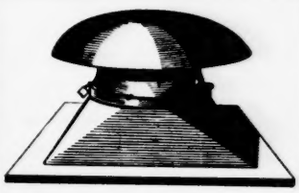
announces that J. C. Kjerner, president and general manager, has been commissioned as First Lieutenant in the U. S. Marine Corps. Fedders—New York Co. is the New York distributor for Fedders Mfg. Co., Inc., Buffalo, and the New York Blower Co. Mr. A. F. Hinrichsen, president of A. F. Hinrichsen, Inc., will carry on Lt. Kjerner's work for the duration.


4 ANSWERS TO VENTILATING PROBLEMS



**1 HEAT AND VAPOR EXHAUST SYSTEMS**

DeBothezat Bifurcators *install right in the duct.* For handling corrosive or high temperature fumes and gases. Motor isolated from fumes in chamber open at both ends. Sizes 18 in. to 4 ft.

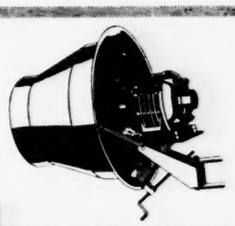


**2 ROOF VENTILATORS**

Assure positive ventilation *regardless* of temperature, humidity and wind velocity. Hinged top gives easy access to motor, fan and shutter. Light-proof; ready for blackout. Sizes: 21", 27", 36".

**3 GENERAL EXHAUST SYSTEMS**

DeBothezat offers a complete series of volume and pressure, axial-flow fans. Non-overloading power characteristic. Guaranteed performance ratings based on wind tunnel tests. Direct drives. Sizes from 18 in. through 10 ft.



**4 FOR BLOWING LINT**

"HY-V" Air Jet combines high-efficiency, axial-flow fan with conversion nozzle for blowing a column of air. Arranged for column or floor mounting. "Air Jet" can be pointed in any direction.

*Literature on all DeBothezat Ventilating Equipment is available on request.*

**De Bothezat**

**VENTILATING EQUIPMENT**

**Division of American Machine and Metals, Inc.**
**East Moline, Illinois**

# PERSONALS AND PERSONNEL

### GERALD E. OTIS

Vice President of The Herman Nelson Corporation, has been appointed industry specialist in the Plumbing and Heating Branch of the War Production Board. Mr. Otis will represent all manufacturers of unit heaters, unit ventilators, convectors, and blast coils, and will advise the War Production Board in matters relating to those products.

### JOHN M. FRANK

President of the Ilg Electric Ventilating Co. of Chicago, was elected President of the National Association of Fan Manufacturers at the meeting of the association Jan. 14 in Buffalo.

### B. DELORENZO

has been appointed manager of the heat transfer department of The Brown Fintube Company of Elyria, Ohio. Mr. DeLorenzo, a graduate of M.I.T. in 1930, spent an additional two years there in graduate study and research, then joined Foster Wheeler Corporation and since 1936 has been design engineer for Foster Wheeler in the oil division.

### F. D. JONES

has been appointed assistant advertising manager for the Copperweld Steel Co.'s Warren, Ohio, division. He will handle the advertising for Copperweld's alloy tool, stainless, and special steels.

### JOHN JAMES

has joined the Iron Fireman Manufacturing Co. and on February 1 began his new duties at the main office of the company in Cleveland, Ohio. Mr. James has become widely known to members of the ASHVE as technical secretary of the Society for the past 7 years and through his many appearances as a speaker, as well as his work on the preparation of the technical data for the annual edition of The Guide.

### HARRY S. WHELLER

has been elected president and general manager of L. J. Wing Mfg. Co., New York, N. Y., manufacturers of fans, unit heaters, blowers and steam turbines. Mr. Wheller, who has been vice president since 1917, succeeds the late Alfred E. Seelig. Other officers elected were Walter W. Wilson, who has been with the company over 30 years, as vice president and treasurer, and Charles H. Smith, who has been with the company for 20 years, as secretary.

### DR. BLAINE B. WESCOTT

chief of the materials and products chemistry division of the Gulf Research and Development Company, Pittsburgh, Pa., has been appointed a member of the Sectional Committee on Pipe Threads of the American Standards Association.

### E. J. GOSSETT

president of Bell & Gossett Company, has been appointed chairman of the 1943 Finance Committee of the Plumbing and Heating Industries Bureau.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*in your steam and condensate lines*
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**The metal of your steam system is precious. Protect it with CORAVOL.** CORAVOL is a volatile and condensible treatment for steam systems. It circulates continuously throughout the steam-condensate circuit, neutralizing acidity caused by carbon dioxide and maintaining the alkaline condition which prevents corrosion. It reaches and protects those parts of the system — steam lines, valves, traps, radiators, condensate return lines — not otherwise accessible. CORAVOL cleans out old rust deposits, increasing heating and operating efficiency. This patented process has been in practical, successful use for over six years. Now more than ever — since replacements are difficult or impossible to obtain — CORAVOL is needed to protect the metal and reduce operating and maintenance costs.

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## INDUSTRIAL DEGREE DAYS
## JANUARY, 1943

| City | Number of Industrial Degree Days | |
|---|---|---|
| | 55F Base | 45F Base |
| Baltimore | 672 | 326 |
| Buffalo | 1047 | 737 |
| Chicago | 1002 | 692 |
| Cleveland | 843 | 533 |
| Detroit | 1032 | 722 |
| Indianapolis | 831 | 526 |
| New York | 748 | 441 |
| Philadelphia | 692 | 384 |
| Pittsburgh | 675 | 377 |
| St. Louis | 712 | 409 |

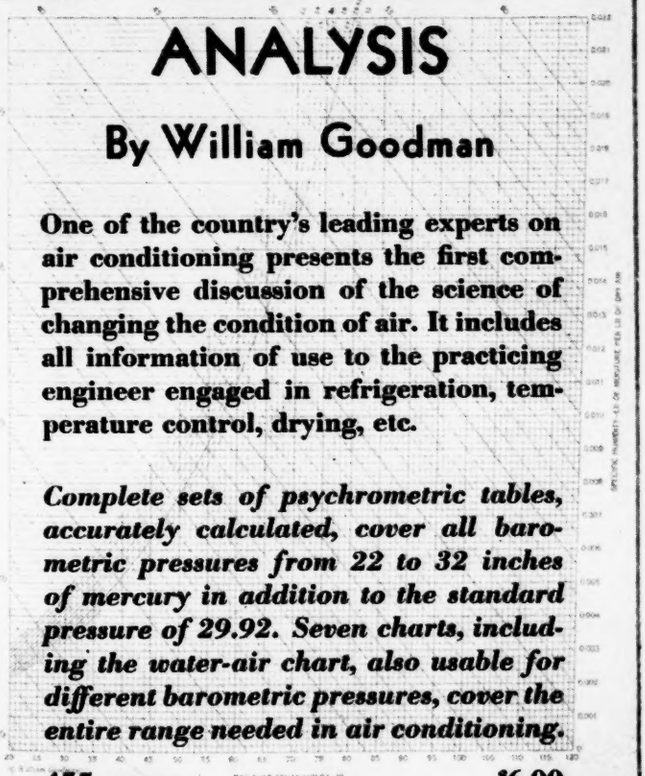
## COMING EVENTS

APRIL 9-10—Midwest Power Conference. To be held at the Palmer House, Chicago, Ill. For further information write to S. E. Winston, Director of Conference, Illinois Institute of Technology, 3300 Federal, Chicago, Ill.

## H&V's PHOTOS

Pages 21-25. Howard Wilcox and Gordon Hansen.
Page 29. (Two bottom photos) The Christian Science Monitor.
Pages 38-39. Division of Industrial Hygiene, N. Y. State Dept. of Health.


# AIR CONDITIONING ANALYSIS



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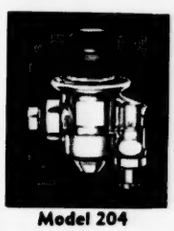
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Model 205

Model 215

DEPENDABLE Refrigerant Valves